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Vice President of the American Dental Association

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Original Communications

GINGIVITIS*

By GRACE ROGERS SPALDING, D.D.S., F.A.A.P., Birmingham, Mich.

AMONG the abnormal conditions affecting the supporting tissues of the teeth of dental patients, gingivitis is probably the most frequent, and most readily diagnosed, and has the most favorable prognosis. Also, it requires quite simple and well-known procedures for its correction and treatment. It is probably because of these facts that it is so generally ignored and, when it receives attention, too frequently the treatment is limited to the topical applications of various drugs by the dentist and the use of salt, sodium perborate and various mouth washes and tooth pastes by the patient.

Gingivitis is at least as nearly universal as dental caries, and it is exceptional to find a mouth that is without the affection in some part. The area involved may be limited to one area in the mouth; for example, the gingival tissue over and about an erupting tooth; the gingiva about a poorly fitting or carelessly finished inlay or one with defective margins; the gingival margin over or near a silicate filling; the gum septum between two teeth with an abnormal relationship of occlusal planes or defective contacts; the gingival tissue under a bridge or a partial denture; the area around tilting teeth, especially without approximating neighbors, or around bridge abutment teeth, particularly where improper clasps are used, and areas where oral hygienic measures have been inadequate. Almost any mechanical irritant may cause gingivitis, such as food impaction, careless or unintelligent use of dental floss or toothpocks or the presence of a detached toothbrush bristle, small fish bones or calculus. The presence of soft deposits invariably produces it and that of certain bacteria can cause serious complications, such as Vincent's infection. The systemic factors are not so

*Read before the Section on Periodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

*This paper and the papers of Drs. Merritt and Leonard, which follow, were presented as a symposium on "Common Diseases of the Periodontium."

readily defined, but clinical experience and scientific evidence have convinced us that metabolic disturbances, dietary deficiencies, pregnancy, menstruation and certain systemic diseases are at times involved in the etiology of gingivitis. In the latter cases, the gingivitis, as we know, is more apt to be general throughout the mouth than localized. This is also usually the case when bacterial infection is the chief etiologic factor.

The fact that the area of gingivitis may be limited to a single gingival septum or to the distal gingival margin of a neglected upper left third molar does not lessen the urgent need for its early recognition, diagnosis and treatment. After thirty-one years of practice devoted exclusively to periodontia, I am of the opinion that neglected gingivitis is usually progressive and, for a limited time only, restricted to the gingival margin. Later, and much sooner than is generally supposed, destructive processes begin in the pericemental membrane and the alveolar bone.

We are all agreed that one of the best ways to protect the pulp of the tooth is to detect and check dental caries in its incipiency, but do we all so fully appreciate that unless gingivitis is also detected in its earliest stages and checked, the pulp is unprotected from an equally formidable enemy? There is no longer any argument about the importance of attention to small cavities, but there is a considerable lack of unanimity as to the relative value of attention to gingivitis, with the exception of Vincent's infection, and we are forced to admit that even then it is the discomfort of the patient which causes his insistent demand for relief and draws our attention forcibly to and arouses our interest in this form of gingivitis.

It is a common experience to see what was in the beginning probably a simple gingivitis neglected even to the loosening of the teeth, and progressing to a condition distinguishable by the patient himself, who then seeks relief, but often too late.

The lengthening of the span of human life should be accompanied by a longer period of usefulness for the natural teeth. Since, according to recent figures, the cause of the loss of more than 50 per cent of the teeth extracted after the age of 50 years is due to periodontal lesions, it would seem that we are not living up to our fullest obligations as a health service when we ignore or treat with indifference the simplest form of these lesions, gingivitis, with its usual long train of destructive sequences: alveolar absorption, extensive inflammation, suppuration, periodontal pockets, pericemental and alveolar abscesses, focal infection and eventual loss of the teeth involved. We are unanimous in condemnation of those who ignore small cavities and we will have progressed considerably when we are also unanimous in our belief that it is of equal importance to prevent gingivitis with every means within our control and to treat any area affected by gingivitis, regardless of its size, with all of the seriousness and dignity that attends any other dental service we render. Because of its importance, gingivitis demands our personal attention and a thorough understanding of possible causes. We are being accused by dental patients of being indifferent to disease of the gums. A number of years ago, G. V. Black examined 500 persons and found that only 5 per cent were entirely free from gingivitis and, of the remaining 95 per cent, in 37 per cent, the condition was due to imperfect dental operations. If, in addition to the foregoing charge of an attitude of indifference, we may also be accused of *producing* 37 per cent of the cases of gingivitis, the situation is grave indeed.

Dental literature contains an abundance of information regarding the prevention, etiology, diagnosis and treatment of gingivitis, and it is doubtful that there is any one present who is unfamiliar with the numerous etiologic factors and the methods of correction. W. H. Perkins,[1] a physician, in a recent article on "The Essential Principles of Hygiene," states:

To oppose or intercept a cause is to prevent or to dissipate its effect.

As well known as this may be, it is the most neglected of all applications in the practice of medicine and the reason for its neglect seems to lie in the failure to think in terms of cause and to too readily assume that our limited knowledge makes it impossible or too difficult to try.

If we would think in terms of cause as regards gingivitis, rather than in terms of treatment, innumerable cases would be prevented.

The prevention of gingivitis may, in some instances, consist of so simple a procedure as the careful removal of all excess cement subgingivally in setting a crown or an inlay; the conscientious finishing of the borders of plastic fillings; the adjusting of occlusion; the prevention of food impaction; providing proper contour and contact for restorations; correcting faulty habits in the use of the toothbrush and dental floss; prompt filling of cavities; guarding tissue about erupting teeth, especially third molars, against infection; reducing the quantity and changing the quality of the mouth flora; providing suitable clasps in partial denture construction; thorough removal of calculus, supragingival and subgingival; specific instruction in the home care of the mouth and of removable prostheses; simple dietary advice when outstanding deficiencies in the diet or faults in its selection are discovered; especial attention to mouths during periods of pregnancy and chronic disease, and avoidance of the use of silicates under or near the gingival margin.

It is generally agreed also that periodontal pockets should be eliminated and persistent flaps over third molars removed to prevent Vincent's gingivitis.

Since the etiology of gingivitis is so apparent in the greater proportion of cases, and its prevention, treatment and correction are easily within the ability of the average dentist, we should be able to furnish a reasonable alibi for its common prevalence in the mouths of dental patients. The alibi usually offered is that "dentists do not like to clean teeth," as if the treatment of gingivitis and periodontoclasia consisted solely of "cleaning teeth." It is human nature to dodge responsibility and in dentistry we find no exception to the rule. Many of us refer partial denture cases to a laboratory for design and construction. We sometimes allow cases of Vincent's infection to advance to an alarming state and then call in a physician. All too many of us turn over gingivitis and even periodontoclasia cases to dental hygienists until the cases are incurable and then refer them to a periodontist or, perhaps, to an exodontist saying, "There is no cure for pyorrhea anyway." The dental hygienist is not qualified by training or education to treat these serious mouth lesions, nor is she legally permitted to do so.

We have a sacred obligation either to qualify ourselves to treat periodontal lesions or to refer these cases to dentists who are capable of correcting them.

Extensive and expensive reconstructive work is frequently done in mouths wherein advanced and untreated periodontal lesions exist, and without the patient understanding or being taught how

1. Perkins, W. H.: J. Periodontol., 7:7 (Jan.) 1936.

to adequately care for the mouths or the new appliances.

Regardless of the beauty of an architectural masterpiece, unless the engineering structure is strong enough to support it and it has a firm foundation, it is not worth the material that was used in its construction. So it is with the most beautifully designed dental restoration: if the physiologic support in the form of a healthy and adequate periodontium is lacking, it is not worth to the patient the metal used in its construction, for its usefulness will be short lived.

If we would but accept the conclusion reached by Gottlieb and other observers that 90 per cent of the so-called pyorrhea cases are or have been marginal inflammations, caused by local irritation, and then apply our knowledge pertaining to these causes, we would save innumerable natural teeth throughout our patients' lives and prolong the comfortable use of many others, at the same time preventing much discomfort, pain and disease. We would be rewarded with the gratitude of those we serve and with greater satisfaction in the improved dental service we could render. The very best dental work is not good enough, unless it prevents and corrects dental and periodontal disease.

Dr. Gottlieb advises that a diagnosis of periodontoclasia be made only in a clean mouth. This recommendation is worthy of serious consideration. It is generally conceded that cleanliness promotes the health of the mouth, especially of the supporting tissues. An unclean mouth is never a healthy one, and, although cleanliness alone does not necessarily constitute health, it is of primary importance in any régime of treatment, prophylactic or corrective.

The mouth should be placed in such a condition that the patient, after adequate instruction, can keep it clean. Cooperation on the patient's part is imperative, and no exception should be made to this rule, for, without it, the value of our services has decided limitations. Too much emphasis cannot be placed on the idea that the patient must keep his own mouth clean and not expect his dentist to do it for him, even if he is willing to pay for it and regardless of how much he is willing to pay. This old-time conception that one goes to the dentist to get one's teeth cleaned (for which we, as dentists, are to blame) is responsible for many cases of gingivitis.

Regular appointments should be made with the dentist, primarily for examination as to health of the supporting tissues and of the teeth and for any treatment needed, and not primarily for cleaning; if we are to establish our position as members of a health service.

We can cooperate continually with our patients in maintaining oral cleanliness, but theirs is the responsibility since they are in control of hygienic conditions daily. We should determine, at every appointment, if necessary, the results of their efforts to keep the exposed tooth surfaces clean. A toothbrush in the hands of a patient, demonstrating just how he brushes his teeth, is one of the most helpful means we can have of determining what advice is needed in the individual case.

Instructions in the home care of the mouth must not be given in a vague, ambiguous or sketchy manner. The directions should be simplified and specific to the point that they are unmistakable. They should always be illustrated.

It has been my experience that most dental patients do try to care for their mouths, but generally with such indifferent results as to question the value of their efforts. Patient, intelligible advice and instruction usually will produce satisfactory results in the case of a willing patient. It is, of course, obvious that we

cannot expect any one to maintain a state of cleanliness in the presence of disease even though it be only incipient gingivitis.

A patient recently applied for advice in what had been diagnosed as a recurring Vincent's infection, which had been annoying him for one and one half years, but had been under constant observation and treatment for only ten months. The patient (a college graduate) brushed his teeth seven times daily with the same toothbrush, but proudly stated that he discarded the old brush and purchased a new one every month. As a result, the oral condition was extremely poor, although for ten months the patient had been treated frequently by his dentist.

In twenty-four hours after coatings of débris and subgingival irritants had been eliminated, with the patient following careful instructions, the entire mouth picture was changed, and the disclosing solution revealed slight traces of films only and those on defective tooth surfaces.

The patient had been miserable and worried, but was eager to cooperate, needing only the removal of irritants and correct, detailed instruction, in the home care of his mouth. Yet, for one and one half years, he had suffered because of a need that had not been met by dental health service.

Gingivitis is so easily recognized that patients frequently discover it through change of color, form or position of the gingiva. The past year, I have had a number of cases referred to me by an osteopath, who, in trying to locate foci of infection, has come to recognize the mouth as one potential source. Most of these cases have been under the regular care of some dentist for many years, and no one had suggested that an abnormal condition existed in the mouth. Some of these have been patients in the early twenties with well established lesions in some of the areas of the mouth and mild, easily correctible gingivitis in other parts.

With all of the clinical evidence to the contrary, it is still the belief of many dentists that periodontoclasia is incurable. This idea is so deeply rooted in dental thought that it is generally considered useless to do anything more than to medicate or to extract. Most cases are still not recognized until the conditions, around some of the teeth at least, have reached an incurable condition; yet that does not justify an attitude of indifference toward gingivitis and periodontoclasia at any stage of their progress.

In many dental practices, no attempt is made to treat any form of periodontal disease, except at the request of the patient, until it is in a state so far advanced that only a much-experienced and skilful operator can cope with it. The usual treatment used then is extraction accompanied by the statement that it is an incurable condition anyway.

It is a common experience of periodontists to have patients apply to them for relief who have made their own diagnosis of gingivitis or periodontoclasia and with an unkindly feeling for the dentist who has disregarded the destructive agencies at work about the teeth, materially shortening the period of their usefulness and destroying the periodontium.

While there are certain dental schools that offer excellent courses in periodontia, there are still too many in which little interest and no enthusiasm regarding the subject are in evidence.

Recent graduates from these schools are not interested in the subject and are unable or unwilling to treat with success even the simplest form of periodontal lesions, gingivitis.

It is a reflection on dentistry that the pressure has had to come from the public demand for relief from the symptoms of periodontal disease. Dental education

should have taken the lead in this and no dental student should have been graduated in recent years from a Class A school who did not recognize the importance of the health of the supporting tissues of the teeth and who was not thoroughly familiar with the etiology, diagnosis and treatment of periodontal disease.

The report of the committee on the Survey of the Dental Curriculum was eagerly anticipated, but to those especially interested in periodontology was disappointing because of the very limited allowance of time for instruction in the most fundamental part of dental practice, that relating to the supporting tissues of the teeth.

The dental student has full confidence in the dental faculty of his carefully selected dental school on entering college and expects to be instructed in the essentials of dental practice. If, on graduation, he has an indifferent attitude as regards the care of the supporting tissues of the teeth and the requirements for their preservation and treatment, he is not fully equipped to practice dentistry or to meet the needs of his patients. The alibi used by some dental educators that "dental students do not like to treat gingivitis or periodontoclasia and are not interested in oral prophylaxis" is an admission of failure to mold the student's opinions and promote his ability to estimate values in dentistry. The successful teaching of any subject is largely dependent on the knowledge and enthusiasm of the instructor.

The supporting tissues must be considered in nearly every phase of the practice of dentistry; otherwise, the service is incomplete and not fully satisfactory either to the operator or to the patient.

To attempt to meet the needs of any dental practice, the dentist must have a deep appreciation of the value of the supporting tissues of the teeth, an understanding of the numerous causative factors of such diseases as attack them and an ability to treat them with prompt results. Frequently, a case is treated superficially for a period of a year or two at so much per treatment with applications of tincture of iodine, or with aquaviolet, if Vincent's infection is suspected. This continues until the teeth are extracted or the patient tries some other dentist. Patients have applied to me for treatment who have been visiting a dentist biweekly for a period of more than one year for topical medication of the gingivae, with but palliative benefits. This prolonging of gingivitis at so much per treatment might well be termed a racket and reported to the Better Business Bureau.

CONCLUSION

1. Recognition and familiarity with the etiologic factors of gingivitis and their prevention, correction and removal are essential procedures in the correct practice of dentistry, regardless of one's opinion concerning discriminating nomenclature or as to where gingivitis ends and other destructive processes begin.

2. When the neglect of gingivitis results in the eventual loss of otherwise healthy and useful teeth, the accusing finger should be pointed first at the patient's dentist and next at the dental school that failed to stress sufficiently the health of the gingival tissues as fundamental in dental health service, and to the function and preservation of the teeth.

3. The common practice of treating gingivitis by topical medication only for temporary relief, thereby prolonging the condition to a serious state, and the too frequent resort to extraction are reprehensible and should be classed as malpractice.

4. The early recognition of gingivitis

and its prompt correction are not less important than the detection of dental caries in its incipiency.

5. The education of a dentist is incomplete without a thorough understanding of periodontal lesions, adequate experience in their diagnosis and trained skill in their treatment.

VINCENT'S INFECTION*

By ARTHUR H. MERRITT, D.D.S., F.A.C.D., F.A.A.P., New York City

IN a study of the literature of Vincent's infection, one is at once impressed by the many conflicting statements that are made regarding its etiology, differential diagnosis and treatment. In many instances, these statements amount to a complete contradiction. By some, it is said that Vincent's infection is not caused by the fusospirochetal organisms[1]; by others, that these organisms are not only causative, but are highly infectious and have a wide range of pathogenicity[2]; by some, that there is no such thing as subacute Vincent's infection[3]; by others, that it is unwise to use instruments in the mouth until after the disease has been brought under control by medication, etc.[4] Others, again, deny each of these statements. This is, to say the least, confusing. One hardly knows whom to believe, for both parties to a controversy cannot be wholly right. For these reasons, it may not be inappropriate to restudy the subject at this time with a view to a clearer understanding of what is, and what is not, the truth. And, in so doing, one must be guided largely by the lamp of experience, remembering meanwhile that there is more than one way of accomplishing a given object, though there is usually one best way.

HISTORY; ETIOLOGY

As long ago as 1883, Miller described the organisms the presence of which is now generally believed to be the cause of Vincent's infection, calling attention to their pathogenicity under certain conditions and stating that they had been found in a finger abscess due to a human bite.[5] In a study of a large number of diphtheria patients in 1894, Plaut found five cases of nondiphtheritic membranous angina, at first thought to be diphtheria in which the fusospirochetal organisms were present. In 1896 and again in 1899, Vincent described a disease of the mouth and

*Read before the Section on Periodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

1. Greenburg, S., and Greenburg, P.: Incidence of Spirochete and Fusiform in Gingival Inflammation and Its Diagnostic Value, D. Cosmos, 71:369 (March) 1929.

2. Smeltzer, J. L.: Diagnosis, Classification and Treatment of Vincent's Infection, J.A.D.A., 8:924 (Nov.) 1921.

3. Tishler, Benjamin: General Practitioner's Misconception of Vincent's Infection, D. Cosmos, 78:178 (Feb.) 1936.

4. Fantus, Bernard: Therapy of Fusospirochetosis, J.A.M.A., 104:741 (March 2) 1935.

5. Miller, W. D.: Micro-Organisms of Human Mouth, Philadelphia: S. S. White Dental Mfg. Co., 1890, p. 80. Lichtenburg, H. H., et. al.: Pathogenicity of Fusiform Bacillus and Spirillum of Plaut-Vincent, J.A.M.A., 100:707 (March 11) 1933. Smith, D. T.: Fuso-Spirochetal Disease, Baltimore: Williams & Wilkins Co., 1932, p. 3.

pharynx that he believed to be caused by the presence of these organisms. The first cases of fusospirochetal infection in America were reported by Sobel and Herrmann in 1901.[6] From that day to the present, many articles regarding these organisms have appeared in medical and dental literature. The consensus of opinion at present is that they are the causative factor in Vincent's infection. This would seem to be confirmed by the fact that successful attempts have been made in recent years to reproduce the disease in experimental animals. Whether the relationship of these organisms in the production of disease is one of true symbiosis is less certain.[7] There are those who believe that one of these organisms is but a transitional form of the other; i.e., that the spirochete is merely a highly differentiated type of the same organism.[8] They are probably present in every mouth, though their number naturally varies with the hygienic state of the mouth.[9] For this reason, positive smears are not of great diagnostic value. Beust says: "The presence of the organisms without a case history proves nothing." Lichtenburg says, further: "One may well question also the rationale of taking smears for Vincent's organisms in ulcerative stomatitis and anginas for diagnostic purposes. Whether many, few or no fusospirochetal organisms, singly or combined, the interpretation of the case and its course remain unchanged."[10] As these organisms are by nature anaerobic, they will be found in greatest number where the oxygen tension is low, as in gingival crevices, periodontal crevices and periodontal pockets and around partially erupted third molars. It is probable that they are saprophytes or opportunists.[11] They thrive on dead organic matter and are not primarily pathogenic, though they may, under certain conditions, assume a highly pathogenic rôle. In a period of two and one half years, seven deaths from Vincent's infection were reported at the Cincinnati General Hospital. All were in adult negroes. Marked neglect of oral hygiene was evident in all cases.[8]

Just why these organisms pass from a saprophytic state to one that is definitely pathogenic is not certain. Local trauma, oral sepsis, dietary deficiency, smoking, the presence of overwhelming numbers of organisms, etc., are suggested as possible explanations.[7] Certain types of blood dyscrasia, such as agranulocytic angina and leukemia, may also act as predisposing conditions.

The answer, then, as to the etiology of Vincent's infection is overwhelmingly in favor of the fusospirochetal organisms. It also seems probable that these organisms are by nature saprophytic and, under usual conditions, not highly infectious.

PATHOLOGY AND DIFFERENTIAL DIAGNOSIS

Vincent's infection is primarily a disease affecting the gingivae, though it may involve the tongue, oral mucosa and lips. When the tonsils are involved, it is known as Vincent's angina. The areas of predilection seem to be, in their order: the lower incisor, the upper incisor and third molar regions. There are, of course, exceptions to this rule.

It may occur in two quite dissimilar forms, which are best described as acute and subacute. This is denied by some observers.[8] Nevertheless, there can be no doubt that there is a type of Vincent's in-

6. Footnote 5, third reference, p. 32.

7. Goldman, Leon, et al.: Fatal Fusospirochetal Angina, J.A.M.A., 101:359 (July 29) 1935.

8. Footnote 7, p. 358.

9. Footnote 5, second reference.

10. Footnote 7, second reference, p. 710.

11. Davis, D. J., and Moorehead, F. B.: Studies of Fusiform Bacilli and Spirochetes, J. D. Res., 5:6 (March) 1923.

fection in which many of the characteristic symptoms of the acute form are absent. While having the appearance of chronic marginal gingivitis, these cases are quite different in their symptomatology.[12] In the acute form, the involved gingivae are characterized by inflammation, swelling and the formation of a necrotic membrane, which can be removed, a raw beeding surface remaining. Under these circumstances, there is usually pain, with a rise in temperature and general debility. Odor and bad taste may also be present.[13] Diagnosis is easily made in these cases, as they are unlike any other gingival disease.

In the subacute form, these symptoms, as might be expected, are less marked. As a rule, less of the gingivae is involved. There is no slough, no temperature and no disability. The involved gingivae have an appearance as in a chronic gingivitis. They are inflamed and bleed easily. Their condition differs in only one respect from chronic marginal gingivitis: the gingivae are sensitive to the touch of a toothbrush or an instrument. This may not be a marked symptom in mild cases, but on its presence in some degree depends the diagnosis. In the absence of pain or tenderness, Vincent's infection may be ruled out, no matter what the other symptoms may be. Positive smears are also unreliable in these cases.

There are two local conditions that predispose one to infection. The first is tobacco smoking.[14] There can be no doubt that smoking lowers resistance. This is apparently due to the irritating effect of nicotine.[15] In all cases, smoking should be prohibited during treatment. The second predisposing condition is oral sepsis. Under poor hygiene, the fusospirochetal organisms in the mouth are greatly increased. At the same time, gingival resistance is lowered. One of the most potent predisposing factors in Vincent's infection is this combination of lowered resistance and increase in the number of organisms. For this reason, oral cleanliness and tissue stimulation is of first importance in the prevention and treatment of this disease; a fact which should always be kept in mind. Bloodgood reports never having found Vincent's infection in an edentulous mouth.[16] Young adults are most susceptible to infection, though it is not uncommon among children.[6] It is an infectious disease, but not highly so. Beust says: "I have never observed a case of infection of a healthy mouth by a patient suffering from the disease."[17] It can be communicated from mouth to mouth. Under conditions of overcrowding and neglect to keep the mouth clean, it may assume an epidemic form. Many such epidemics have been reported, doubtless with more or less exaggeration. In a recent college epidemic, one of the students appeared at my office. She stated that it was generally known among the students that there was an epidemic of Vincent's infection in the college and fearing that she might contract the disease, she had gone to a dentist, who took a smear and, finding it positive, confirmed her suspicions. Alarmed at this, she returned to her home in New York. An examination

12. Pilot, Isadore: Fusospirochetal Infection of Mouth, J.A.D.A., 15:1764 (Sept.) 1928. Reichmann, F. J.: Vincent's Infection—Acute and Chronic, J.A.D.A., 13:1665 (Dec.) 1926.

13. Footnote 12, first reference.

14. Hirschfeld, Isador: Vincent's Infection: Cause and Treatment, J.A.D.A., 16:624 (April) 1929.

15. Reppeto, W. M.: Disc. Thompson, A. J.: Vincent's Infection, J.A.D.A., 18:1411 (Aug.) 1931.

16. Bloodgood, J. C.: Oral Lesions Due to Vincent's Angina, J.A.M.A., 88:1143 (April 9) 1927.

17. Beust, T. B.: Oral Manifestations and Treatment of Vincent's Infection, J. D. Res., 10:97 (Feb.) 1930.

of her mouth showed no clinical evidence whatever of Vincent's infection. The subjective symptoms were also negative. There was no history of pain or sensitiveness as there would have been even in a subacute case. A few areas of septal gingivae showed the presence of an incipient gingivitis; nothing more. Yet this was probably one of the cases reported in this so-called epidemic. How many other such cases there may have been no one will ever know.

Probably most patients are self-infected. Lowered resistance, plus the presence of the organisms in the mouth, is sufficient to explain this. One is hardly justified in charging the patient in these cases with "osculatory reciprocity": there are other and more probable explanations. The weight of evidence, therefore, indicates that Vincent's infection may occur in two forms, acute and subacute. There are those who believe there is a third type, which they classify as chronic.[18] Its existence seems doubtful.[19]

TREATMENT

Since the cause of Vincent's infection is known, treatment should be directed toward the control of the fusospirochetal organisms and the conditions that predispose the patient to infection. First and foremost in this control is the establishment, at the earliest possible moment, of mouth sanitation. In this effort, treatment is directed toward the reduction of the infecting organisms and increasing local resistance. This is the only logical approach. On this point, Beust says[17]:

> A discussion of the microbial phase of Vincent's infection should logically consider the means for the disposal of the microbes. The great lesson taught by the microscope has not, in my estimation, been heeded by the profession. It is not the determination of variety, but the demonstration of the presence of microbes, that is important. We have learned from microscopic examination that, in this lesion, the interdental spaces and gingival pockets are filled with a teeming mass of virus. Notwithstanding this knowledge it is common practice to handle these cases gingerly —to trust to the defenses of the patient to ward off the onslaught. The treatment given by the average practitioner is practically useless. Superficial applications will never affect the organisms in the interior of the pocket. These concealed armies are the real offenders. If the best is to be done for the patient, then the activities of the organisms must immediately be suppressed. The hemorrhage incident to an immediate energetic treatment disperses the bacteria and their products, reduces the hyperemia, and affords almost instantaneous relief to the patient. If the pockets are evacuated and left surgically clean, the much feared spread of the disease will never occur. . . . The effect will be gratifying to both operator and patient.

A diagnosis of Vincent's infection having been made, the first step in its control is a prophylactic treatment; for it is true, as has been said, that "cleanliness is more important than antisepsis."[19] This should be done carefully and as thoroughly as conditions permit. All gross tartar should be removed. Instruments should be carefully passed into each gingival crevice throughout its entire circumference, if possible, for the purpose of emptying it of its septic and irritating contents. This is followed by frequent spraying of the mouth. In this way, many of the organisms that it would be difficult to reach by medication are removed from the mouth. This is the first and most important step in treatment. For this reason, the treatment of Vincent's infection is essentially a dental and not a medical problem. On this point, Leon Goldman,

18. Cobe, H. M., and Grace, L. G.: Ulceromembranous Gingivitis, D. Cosmos, 73:467 (May) 1931.

19. Goadby, Kenneth: Diseases of Gums and Oral Mucous Membrane, 4 Ed., London: Oxford University Press, 1931, p. 51.

M.D., says: "The prophylaxis, then, rests in the hands of the dentists in the maintenance of good oral hygiene."[8]

The second step in treatment is the use of oxydizing drugs to destroy the remaining fusospirochetal organisms. For this purpose, there is nothing better than a 5 per cent solution of chromium trioxide (chromic acid) (H_2CrO_4). Being a trioxide, it occupies first place among oxygen-liberating preparations, a 5 per cent solution yielding about 20 per cent of available oxygen. Chromium trioxide is applied by saturating a pledget of cotton and bathing the teeth, permitting it to flow into each gingival sulcus and over the gums. It is not necessary to use a napkin in the mouth. The acid solution should be allowed to remain in contact for several minutes, during which time the surfaces of the teeth are carefully polished. The mouth is then sprayed and the same procedure followed with the other jaw. This should be repeated several times at each visit in order to obtain the oxydizing effect of the chromium trioxide. The same course is followed at each subsequent visit. The patient is prohibited from smoking or taking alcohol during treatment. Mouth washes should be prescribed for home use. The following will be found to be most efficacious:

Hydrogen dioxide aquae	8 ounces
Corrosive Mercuric Chloride	2 grains

Sig. Two teaspoonfuls in one half glass of warm water, used as a mouth wash every hour the first day, three or four times daily thereafter.

Potassium permanganate stands second as an oxygen-liberating agent, with a yield of about 16 per cent. Hydrogen dioxide is another valuable oxydizing solution, yielding about ten volumes of free oxygen, which gives it its value as a mouth wash in these cases. A mouth wash of hydrogen dioxide may be alternated if desired with a wash composed of:

Potassium permanganate	20 grains
Distilled water	8 ounces

Sig. A tablespoonful in a quarter glass of warm water; used every hour as a mouth wash.

This has the disadvantage of possible staining of the teeth and usually has no superiority over the hydrogen dioxide wash. The arsenicals do not appear to be of great value in the treatment of Vincent's infection, though good results from their local use are reported by some writers. Cobe and Grace say: "Neoarsphenamin or sulph-arsphenamin applied topically daily has been extensively used but has proved of little value in our hands. Nor can we see the rationale of intravenous injections unless it can be demonstrated that the organisms have entered the blood. This treatment has been tried repeatedly with dispensary patients with no result."[19] In Accepted Dental Remedies, it is stated that, "Intravenous administration of the drug (arsphenamine) cannot reach the spirilla imbedded in the necrotic tissue of the throat."[20]

The number of times the patient should be seen and the frequency of the visits will depend on the severity of the case. Usually from once a day to once or twice a week and from three to half a dozen visits will suffice in most cases. At each visit, the treatment outlined above should be carried out, application of the chromium trioxide being followed with careful prophylaxis. All treatment is directed to one end; namely, the establishment and maintenance of a high order of oral cleanliness for the purpose of reducing the number of fusospirochetal organisms and promoting local resistance. The latter is of first importance; for, if maintained at a high level, it is not likely to be broken down, no matter how abundant the organisms may be.

20. Accepted Dental Remedies, 1934, p. 46.

SUMMARY

1. The presence of fusospirochetal organisms is the direct cause of Vincent's infection.

2. These organisms are infectious and may be communicated from mouth to mouth, but, in most cases, the patient is probably self-infected.

3. Vincent's infection may occur in two forms: an acute, in which there is sloughing, pain, rise in temperature, etc.; the other, a subacute type, characterized by inflammation of certain areas of the gingivae, bleeding and sensitiveness. Differential diagnosis in these cases depends on the symptom of tenderness.[21]

4. The first and most important step in treatment is subgingival therapy, cleaning the mouth and teeth as thoroughly as can be done without injury to the gingival tissues.

5. The application of oxydizing drugs directly to the teeth and gums is the logical therapeutic treatment. Of these drugs, there are none more efficient than a 5 per cent solution of chromium trioxide (chromic acid).

6. The arsenicals, when used intravenously, are not of great value as far as local conditions are concerned.

7. Vincent's infection can be largely prevented by the maintenance of a high standard of oral cleanliness and temperance in smoking.

21. Rosenthal, S. L.: Outline and Classification of Vincent's Disease, D. Cosmos, 71:890 (Sept.) 1929.

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PERIODONTOCLASIA*

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THE word "periodontoclasia" means a breaking down of the investing tissues of a tooth. It is a local disease in which the attaching fibers of the tooth root and the alveolar bone are progressively destroyed by inflammation. The inflammation in turn is caused by a variety of local conditions of which accumulation of bacteria and deposition of calculus on the tooth surface, excessive stress on the tooth and food impaction are the most important.

Inflammation and infection occur more readily in tissues in which the blood supply is meager or sluggish or in which the tissue cells are improperly nourished or are poisoned. Vitamin deficiencies, disease of the blood vessels and the presence of metabolic toxins and poisons play a part in some cases by promoting inflammation and infection. Otherwise, these three conditions may be disregarded in a practical consideration of the etiology and treatment of periodontoclasia. The greater the emphasis on local causes of inflammation and their elimination, the greater the success in treatment. The idea of a direct systemic causation leads the practitioner off the track into a realm of uncertainty and speculation, to the neglect of simple local conditions that can easily be discovered. After many years of persistent work to discover systemic causes of periodontoclasia, I am convinced that

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the number of cases having a systemic origin is negligible, if there are any at all in which systemic conditions play a part other than to lower tissue vitality and open the way to local infection.

It is essential for intelligent treatment that the practitioner understand clearly the pathology of periodontoclasia. Under normal conditions, the root of the tooth is suspended in white fibrous connective tissue, the fibers of which are attached to the root by being imbedded in cementum. The opposite ends of all the fibers below the level of the alveolar crest are attached in the lamina dura of the alveolar process. The fibers above the level of the alveolar crest make up the bulk of the gingiva and pass in such directions that they hold the marginal gingiva firmly in place against the crown of the tooth. The marginal gingiva is covered by stratified squamous epithelium, which dips into the gingival crevice or sulcus and is attached to the tooth in a band of variable width. For some time after eruption, the attachment of the epithelial band is on the crown of the tooth; but as age advances and the gingival margin recedes, the attachment of the epithelial band progresses rootward at the expense of the connective tissue fibers of the pericementum. In old age, the base of the gingival crevice will usually be somewhat rootward of the amelocemental line of the tooth even in cases wherein no inflammation has existed. Under normal conditions, the rate of gingival recession and the progress of the advancing epithelial band attachment are the same, so that the gingival crevice remains of small depth, from 1 to 2 mm. on the labiobuccal and lingual surfaces and from 3 to 4 mm. on the proximal. Just how the advancing band of epithelium attaches itself to the enamel and cementum is unknown, but presumably it is by gluing itself on by means of a layer of keratin, the substance that makes up the outer layers of the skin. The epithelium can be readily split away from the tooth surface, but the layer of keratin will remain firmly attached.

When bacterial masses accumulate on the tooth surface, the marginal gingiva becomes inflamed. This means that fluid accumulates in the marginal gingiva; large numbers of lymphocytes and plasma cells gather under the epithelium at the base of the gingival crevice; the connective tissue fibers are softened and lose their tension, and the epithelium becomes degenerated. Loosening of the connective tissue fibers permits the marginal gingiva to hang away from the enamel so that mechanical agents may easily split the epithelium of the attachment away from the tooth and deepen the crevice. In the effort to wall off the invading microorganisms, the epithelium tends to proliferate and the effect of the growth is to advance the band of attachment considerably farther along the root at the expense of the pericementum. Further splitting of this epithelium from the tooth root leads to a definite periclasial pocket. As the epithelial growth keeps up with the advance of the pocket, the latter is always covered by epithelium even though very degenerate and faulty, and the band of attachment lies at the base of the pocket.

The degeneration of the epithelial lining of the gingival crevice and pocket is important. Microscopically, the epithelial cells stain poorly and are separated from one another; the basement membrane is indistinct, and the connective tissue papillae may, in patches, be uncovered so that blood vessels are exposed to the surface. Tissue fluid exudes from such a surface, together with leukocytes. The least manipulation causes capillaries of the exposed connective tissue papillae to burst and bleed into the crevice or pocket. From the fluid exuding and stagnating in the crevice, or pocket, subgingival calculus

forms on the tooth surface under conditions presumably identical with those which cause calculus to form from stagnating saliva on the exposed surfaces of the teeth. Although it comes from tissue fluid and exudate rather than saliva, it is much the same in composition except that it is darker from incorporation of blood pigment in it. The presence of calculus under the gingiva is extremely important, not because it is rough, but because it is porous and filled with living pathogenic micro-organisms; which causes a profound irritation and inflammation of the adjacent tissue.

A pocket once started, with formation of subgingival calculus, tends to progress automatically. The presence of calculus causes a zone of inflammation about the pocket which tends to deepen it. The pocket, once deepened, gives a surface for more calculus formation farther along the root. Unless interrupted by mechanical interference, the disease condition progresses to the end of the root and the tooth is lost.

The advancing zone of inflammation reaches the alveolar crest early in its progress. The effect of inflammation on bone is to cause rarefaction and resorption. Deep inflammation of the gingiva is soon reflected in recession and rarefaction at the alveolar crest, as seen in the roentgenogram. Such rarefied bone is not necrotic. It is simply being dissolved by osteoclasis to make room for inflammatory elements fighting the invading micro-organisms. The resorbing alveolar crest is, with few exceptions, always well ahead of the advancing pocket. In some instances, it may be far ahead so that roentgenograms may indicate extensive bone resorption, while pockets may be relatively shallow.

The bacteria concerned in periodontoclasia are predominantly of the *Streptococcus viridans* group. Staphylococcic organisms may contribute in certain cases where the chemical condition of the tissue is favorable and may hasten the process by their well-known ability to secrete enzymes, which dissolve connective tissue fibers. Vincent's organisms are usually present in periclasial pockets and undoubtedly contribute their destructive action, which shows its effects in those cases in which the subgingival tissues are unusually sensitive to probing or instrumentation. *Streptococcus viridans* has in marked degree the power to penetrate and live in the tissue while causing only a sluggish tissue reaction and chronic inflammation. Its deep penetration can be deduced from the fact that it has been found, in almost all cases tested, in the living healthy pulp of intact teeth wherein any marked gingivitis or periodontoclasia existed about the tooth.[1] It has penetrated, via the lymph channels, to the apex, and thence up into the pulp. It probably is a menace to health only when it has penetrated in such numbers that a chronic inflammation and stagnation of the blood supply result and the micro-organisms can get into the capillaries and be carried to remote parts.

The treatment of periodontoclasia that is caused by the presence of bacterial deposits and calculus is simple in principle. The root surfaces are shaved to smoothness by subgingival curettage and the patient is put on a home care technic that keeps the tooth surfaces clean and, at the same time, massages the periodontal tissues.

While the principles of treatment are simple, the technic involved is not easy or has not been well taught, since comparatively few dentists get the results that may be expected from competent

1. Collins, K. R., and Lyne, H. C.: Preliminary Report on Bacteria Found in Apical Tissue and Pulp of Extracted Teeth, J.N.D.A., 6:370 (April) 1919.

treatment. One difficulty is the fact that subgingival curettage must all be done out of sight, by the sense of touch. It takes much time and practice under competent supervision to train the sense of touch to the point where the practitioner may be confident that he has removed all calculus and organic matter from the root surface, and has left it smooth, without curetting through the thin cementum into the highly porous dentin underneath. Instruments must be well adapted to reach into the deepest portions of the pocket and shave the root surface without injuring the attachment at the base of the pocket or lacerating or stretching the overlying soft tissue. The exact type of instrument is more a matter of convenience to the operator and of comfort to the patient than of effectiveness in result. A well-trained operator will be able to give an effective root-surface curettage with curet scalers, hoe scalers, prophylactic files and push instruments of many different types. Many periodontists give ideal curettage with not to exceed a dozen carefully selected instruments. The principal factor is the trained sense of touch and a knowledge of the tissues on which one is operating.

Among the structures that must be distinguished in root surface curettage are the attaching soft tissues at the base of the pocket, which feel springy when reached, yet resist further progress with the rounded blunt end of the curet. Subgingival calculus feels hard and gritty as the curet passes over it and can be distinguished from the cementum even when no edge of calculus can be engaged. The cementum itself feels different in different parts of the tooth and in different persons. Toward the root apex or in the bifurcation area of roots, the cementum is cellular and cannot be rendered so smooth as the noncellular cementum of the gingival half of the root. The cementum is thin in places and, with excessive curettage, may be penetrated, the curet touching the dentin. The dentin beneath the cementum is very cancellous and gives a feeling as of passing over porous wood as it is curetted. In vital teeth, the dentin is sensitive and the patient generally lets the operator know when it is reached. In very rare cases, the crest of the alveolar process may be exposed at the depth of the pocket and must be distinguished by touch from a mass of calculus or an absorption cavity in the root surface. These differing structures, in addition to the wide variety in the shape of the roots themselves, offer many difficulties in the treatment of root surfaces.

The porosity of apical and bifurcation cementum affords one explanation as to why very deep pockets resist treatment. A porous structure filled with bacteria cannot be rendered entirely nonirritating to the soft tissues lying against it. The porous structure of exposed dentin also militates against successful healing of pockets, and for the same reason. Excessive curettage, which exposes the dentin, is therefore almost as bad as insufficient curettage, which leaves masses of calculus on the root surfaces.

After the root surfaces of the teeth are perfectly curetted, the patient is put on a home care technic by which the teeth are kept completely clean and shiny to the gingival margin and the periodontal tissues are massaged. Massage is a series of compressions and releases of the tissue. By compression, the stagnant fluids containing bacteria are forced out into the lymph channels and veins and carried away. By release, a new supply of arterial blood is brought in. A series of pressures and releases, therefore, has the effect of rinsing out the tissue. Repeated night and morning for a series of days, massage of the inflamed tissues overlying curetted root surfaces has the effect of ridding

them of bacteria, congestion and inflammation and permitting healing.

Healing, in this case, means that connective tissue fibers take the place of infected granulation tissue and bind the gingiva tightly against the tooth. The epithelium lining the pocket becomes healthy and grows against the tooth, attaching itself to the tooth surface in the same way that the normal epithelial attachment occurred. Thus, the pocket is obliterated, not by a pericementum such as existed originally, but by an epithelial attachment.

My reasons for believing that the obliteration of pockets, which ordinarily occurs after treatment by competent periodontists, is due to epithelial attachment are:

1. It occurs too rapidly to be attributable to connective tissue reattachment. In two or three weeks after treatment, in most cases, the pockets are obliterated.

2. Histologic evidence offered by Box[2] proves that epithelial reattachment does occur; while there is as yet insufficient proof that a connective tissue reattachment involving the growth of new principal fibers and new layers of cementum does commonly occur.

3. It is seldom that one can see in the roentgenogram a regrowth of alveolar bone to a point higher than the former base of the pocket. If a new pericementum did form, it is reasonable to suppose that new alveolar bone would grow in to support it.

4. If the home care is neglected later on, the pockets open up to their former depth in a comparatively short time; which indicates that there is a weaker than normal type of attachment.

Whether the reattachment is wholly epithelial, I am convinced that it is real, and that it is vastly important to conserve the tissues overlying pockets to allow for such reattachment. I am therefore opposed to the school of thought among periodontists that resorts to surgical procedure as a routine in the treatment of periclasial pockets. It is important to conserve the covering of the roots for several reasons: It looks better and feels better to the patient. It is easier to keep the teeth clean than when resection has been practiced. Furthermore, it allows for the maximum rebuilding of alveolar bone. At least, no bone is cut away. Roentgenograms taken later usually show bone rebuilt as far as the base of the former pockets with normal dense lamina dura lines overlying the crests. As long as inflammation and pockets can be as successfully eliminated by conservative as by surgical methods, it seems to me that the advantages to the patient are all in favor of saving the soft tissues overlying pockets.

This does not mean that there is no place for resection in the conservative treatment of periodontoclasia. There are many areas that cannot be kept clean without resort to surgical preparation. Deep holes between the teeth due to food impaction or a former Vincent's infection invite food retention and are impossible to maintain in a sanitary condition unless the overlying labial or buccal wall of tissue is removed by the patient to give access to cleansing instruments. Loss of attachment to bifurcations in lower molar roots leads to insanitary conditions because treatment, in these cases, does not lead to reattachment. The anatomic structure is such that contraction of connective tissue as it heals draws the investing tissue away from the bifurcation and leaves an insanitary space. By removal of the buccal plate of soft tissue overlying the bifurcation, access is obtained for cleansing the remaining tissue and maintaining it in health.

2. Box, H. K.: Bull. 7, Canadian Dental Research Foundation, p. 75.

For home care in periodontoclasia, the most effective means that I have found is Charter's toothbrush technic, using the hardest bristle toothbrush available. The unbleached hard brushes serve my purpose. The bristles are directed or bent away from the gingiva at a 45 degree angle and the bristle ends are applied in a small round and round stroke that cleanses the slime from the tooth surface and gives a definite compression with the sides of the bristles to the gingival margin at each revolution. From twelve to fifteen strokes are applied to each area. The brush is held with enough pressure that the patient feels the compression as the sides of the bristles impinge on the gingiva. It is not held so hard that the bristles are smashed or locked between the teeth. On the lingual surfaces, a diagonal stroke accomplishes the purpose. (Two and one-half minutes is sufficient time to brush the teeth night and morning in the ordinary case.)

Three objectives are to be borne in mind by the patient: 1. The bristle ends must cleanse the tooth surfaces to the gingival margin. 2. The gingiva must be definitely compressed at each stroke with the sides of the bristles. 3. The gingiva is never to be scrubbed or touched with the bristle ends.

In regard to the third point, I am convinced that in the majority of cases, gingival recession is due to some form of gingival scrubbing. Many teeth have no bone on the labial surface for more than half the distance toward the apex. Examination of skulls indicates that such lack of bone is a common defect in modern human beings even when there are no signs that periodontoclasia has been present. Removing the outer corneal layers of cells of the gingival epithelium in a case wherein there is no underlying bone causes rapid recession. This is true whether the thin soft tissue is attached to the root by a normal pericemental attachment or by an epithelial reattachment. No object is served by frictional scrubbing of the gingiva. What is desired is compression and release of the tissue to the depth of the inflamed zone in periodontoclasia cases, not removal of the outer cells of epithelium.

The massage effected by the sides of the bristles in Charter's brushing technic is sufficient to compress the tissues to the depth of the congested zone if the pockets are shallow, but is insufficient if the zone of inflammation is deep. In deep areas of congestion, supplementary massage in the form of intermittent finger pressure and release on the areas of tenderness is indicated. Better yet, a rubber brush fitting over the finger as a finger cot, is excellent as a deep massaging instrument, since the rubber points work into the soft areas of the gingiva and manipulate the tissue far more effectively than can the blunt finger end alone.

Dental floss is an essential adjunct in home care in all cases in which spaces exist between the teeth. The floss is both a cleansing and a massaging device. With a very short span held tightly over two finger ends, it is forced through the contact point into the space beneath with such control as not to cut into the gingiva. It is then bent around one proximal tooth surface and worked up and down from the base of the gingival crevice to the contact point with such pressure that all bacterial slime is thoroughly cleansed from the tooth surface. It should pass beneath the gingiva and near enough to the base of the crevice to give a definitely felt punch to that tissue, but not so far or so hard as to cause pain or injury. The base of a crevice that is sore or bleeds on application of floss is inflamed and ulcerated, and is in particular need of the floss treatment. Cleansing and massage by the floss will soon result in healthy

skin covering the crevice surface, after which it will no longer be sore or hemorrhagic. Needless to say, there are two tooth surfaces to cleanse and gingival cervices to massage for each proximal space.

The discussion of periodontoclasia so far has been concerned with simple bacterial invasion and calculus formation due to uncleanliness about the teeth. Another equally important phase is concerned with mechanical injury of the periodontal tissues that opens the way for deep infections not necessarily associated with insanitation.

The tooth is suspended in the alveolar socket by means of connective tissue fibers, which are so arranged as to give movement to the tooth in its socket and to act as a cushion for tooth and bone in the pressure of mastication. If a tooth is not adjusted in occlusion and interferes with mandibular movements, excessive pressure will be inflicted on the pericementum and alveolar bone supporting the side of the tooth where the interference is felt. Under physiologic conditions, the alveolar bone is dissolved away at the pressure points and the tooth shifts in its position so as no longer to interfere with jaw movements. New bone fills in where the tooth has drawn away and the tooth becomes firmly attached in its new position by means of new pericemental fibers, new bone and new layers of cementum. This process of adjustment is the normal one during the time the teeth are erupting and becoming adjusted to their occlusal relations, and later, as wear or mechanical interference changes these relations. The physiologic mechanism is adequate as long as the adjustments are gradual and it is possible for the teeth to find positions permitting adjustment.

When the shifting of the tooth is rapid or the tooth cannot find a position in which it is free of excessive stress, the condition of the periodontal membrane on the side of stress becomes pathologic. Bone is dissolved and the peridental membrane between tooth and bone is thickened. The movement of the tooth back and forth during the masticatory motions prevents new bone from building in on the opposite side to stabilize the tooth. The result, on the traumatized side, is a set of vascular, degenerative and inflammatory changes, which open the way for destructive infection from without, resulting in deep periclasial pockets.

Still another type of injury that is a common cause of the formation of periclasial pockets is food impaction. Any anatomic condition of the teeth that permits food fibers and particles to be forced into the gingival crevice of a tooth is bound to cause destructive changes at the base of the crevice. Food impaction is not confined to proximal areas of teeth, but may occur on the lingual aspect of upper anterior teeth in excessive overbite; on the labial aspect of lower anterior teeth in cases of lingual inclination of the upper anterior teeth, and at other places where teeth overlap. The food fibers act as a mechanical wedge to split the epithelium away from the tooth surface and, if the food is long retained, act as a very highly irritating foreign body causing intense inflammation and congestion of the surrounding tissue.

The effects of food impaction constitute a vicious circle. The food particles cause inflammation of the marginal and cemental gingiva. The inflammation tends to force the teeth apart in the case of proximal food impaction and the separation permits increased food impaction. The inflammation also allows the gingiva to hang loosely away from the tooth so that food particles can easily reach the base of the crevice, splitting the epithelial attachment from the tooth and remaining

to act as an irritating foreign body. The circle may be broken and the condition treated successfully in some cases by keeping the area clean, while massage restores the normal health and tightness of the gingiva and permits the teeth to move together into close contact.

The treatment of undue stresses on the teeth and food impaction, with few exceptions, involves much more than root surface curettage and home care. They call for diagnostic ability of a high order, together with the resources of all the branches of restorative dentistry and orthodontia. The majority of periodontia cases need, as part of the service of preventing eventual destruction of the teeth, various dental procedures in order that the teeth may be put into a condition of adjusted occlusion and balance, which will prevent shifting and the development of injurious stresses.

Among the most potent and least recognized causes of destruction of the teeth is the unrestored loss of the lower first molar. When this tooth is lost before the age of 12, its place may be taken by the erupting second molar in such a way as to leave no harmful fault in the occlusion. When it is lost after the second molars have erupted, a series of changes, with few exceptions, occur in the relations of the teeth all of which are destructive and many of which lead to periodontoclasia. These have been listed many times, but apparently the facts have not percolated to the minds of some of the profession, for we frequently see patients who have had dental examination and treatment regularly for years and who are about to lose their teeth because a missing lower first molar has never been restored.

The lower first molar is the most frequently lost of all of the teeth. Erupting as it does behind the deciduous teeth during the age of maximum caries susceptibility and minimum mouth care, it usually decays in childhood. If it is filled at all, it is poorly filled with amalgam, with recurrent caries and death of the pulp later on. The statistical figures of Brekhus[3] tell the story. At age 20, 47 per cent of women and 40 per cent of men have lost one or more lower first molars; at age 40, 75 per cent of women and 63 per cent of men; at age 60, 86 per cent of women and 80 per cent of men.

The following destructive effects are commonly observed after the loss of the lower first molar: The second lower molar and third lower molar tip mesially and lingually; which leads to a faulty contact between these teeth resulting in food impaction and its sequelae. The tipped teeth no longer fully oppose the mandibular muscles; which results in a closing of the bite or diminution in vertical dimension. The tipped teeth tend to be moved in their sockets during masticatory movements. A healthy tooth capable of withstanding a pressure of 100 or more pounds in the direction of its vertical axis is capable of sustaining but a fraction of that pressure in a lateral direction. As a result of such lateral stress on these teeth, there is loss of bone, and degenerative changes occur in the mesial and lingual peridental membranes, which open the way for deep periclasial pockets.

The upper molars are also deleteriously affected. The upper first molar tends to extrude and tip buccally, loss of proximal contact with adjacent teeth and, in turn, food impaction resulting. Extrusion and buccal tipping also tend to thrust the palatal root out of the bone and soft tissue into the palate. Deep recession and even complete denudation of this root are the result. The second and third upper molars also tend to adjust themselves to the lingual tipping of the lower molars

3. Brekhus, P. J.: Statistical Investigation of Loss of Human Teeth, J.A.D.A., 15:679 (April) 1928.

by tipping buccally, with similar but lesser effects on their palatal roots.

The loss of occlusal support occasioned by tipping of the lower molars brings great stress on the bicuspids, both upper and lower. The lower bicuspids tend to drift or tip distally and may be rotated. In drifting distally, they are obliged, at one stage, to occlude end to end with the upper bicuspids during the time that vertical dimension is diminishing. This means that the lower or upper bicuspids, or both, are intruded; that is, forced up into their sockets. The stresses incident to these movements may open the way to deep periclasial involvements on these teeth. The separation of the lower bicuspids also opens the way for food impaction.

The closing bite and loss of distal support cause changes in the anterior region. The lower incisors and cuspids tend to drift distally and lingually. The effect of closing of the bite and lingual drifting is to place the incisal edges of the lower anterior teeth high up behind the lingual eminences of the upper teeth. Any anterior movement of the jaw tends to drive the upper anterior teeth forward in a fan shape and to loosen both the upper and lower incisors. The lower anterior teeth also tend to impact food into the lingual gingival crevices of the upper, with consequent periclasial pocket formation. Unless the supporting bone is very dense about these teeth and periodontal care very good, periodontoclasia is almost certain to occur around some of these teeth.

In closed bite cases, another factor that contributes to periodontoclasia is faulty salivary circulation. It is believed by students of this subject that the closed relation forces the tongue backward into the pharynx and interferes with the suction action on the teeth during the first act in swallowing. Saliva is not freely moved about the teeth as it is in the normal swallowing act. The result is salivary stagnation on the buccal surfaces of the teeth, with a tendency to bacterial accumulation at the necks of the teeth and consequent (1) formation of cervical carious cavities or (2) gingivitis or (3) periclasial pockets, or all three. Whether this is the correct explanation, it seems to be a fact that bacterial accumulation on the buccal cervical areas is a common accompaniment of the closed bite. When the bite is opened by appropriate procedures, this tendency disappears.

It is not within the province of this paper dealing with periodontoclasia to detail other effects of closing of the bite from loss of a lower first molar as they affect the tendency to caries, the shape of the mandible, the changes in the temporomandibular joint and possibly auditory conditions. It is sufficient to repeat that no one common defect allowed to go over a period of years has a more profound and destructive effect on the masticatory mechanism and adjacent parts than the unrestored loss of a lower first molar. It is true that, in certain cases of end-to-end bite or of very dense alveolar bone, the changes noted will be very slow or negligible. In the main, the indictment must stand that the unrestored loss of a lower first molar is one of the most certain causes of periodontoclasia.

The loss of other teeth may have deleterious effects leading to periodontoclasia; but none, in my opinion, are so severe or far-reaching as the loss of the lower first molar. If the lower first molars remain intact, vertical dimension is maintained unless several other teeth are lost. It is the loss of vertical dimension that causes such wreckage in the mouth. The loss of any teeth that are serving to maintain the occlusal level and to support adjacent teeth places an additional load on the remaining teeth and may permit shifts of the teeth, with food impaction and trau-

matic stress, which open the way to periodontoclasia.

The treatment of teeth that are tipped and shifted and interfere with each other in mandibular movements until they are loose is a matter for the greatest judgment and skill. The first consideration is the health of the periodontal tissues, tightening of the teeth in the bone and obliteration of the pockets. The second is the building up of the mouth in such a way that the teeth are braced against mesial or distal movement and are adjusted by their occlusal form to the lateral and other excursive movements of the jaws.

The subject of grinding interfering points naturally comes up at this point. Grinding to adjust the occlusion is a necessary procedure in many periodontia cases, but it is by no means the panacea that some dentists would have us believe. Grinding interfering points in a dentition which is gradually closing and shifting from loss of a lower first molar would hardly be adequate to check the development of further destructive changes. The promiscuous grinding of occluding cusps as detected by carbon paper marks until the tooth is disoccluded or until all occlusal form is lost will not prevent recurrence of stress as the teeth extrude to meet their antagonists. Grinding is a treatment to be used sparingly, mostly as a temporary means of relieving stress while healing is taking place in the periodontal tissues. It is useful in obliterating interfering points in teeth that are out of line and cannot otherwise be brought into harmonious occlusal adjustment. As a general means of adjusting an occlusion in which the bite is closed and the teeth are already worn flat, grinding is, in my opinion, a failure.

In planning the treatment of a mutilated masticating mechanism in which teeth are loose and periodontal pockets are present, it is pertinent to inquire which teeth are to be saved and which lost for the benefit of the whole. As a rule, teeth that have lost their attaching tissues more than half way to the apex all around the root may be considered hopeless. Such teeth have so little anchorage that they cannot withstand normal functional stress. Teeth that have pockets reaching to the apical fourth of the root can seldom be made healthy or maintained so. In the first place, it is impossible to get cementum in the apical region smooth because of its porous character and, in the second place, it is difficult to devise a technic by which massage may be applied to reach the deepest zone of inflammatory tissue. Teeth that have the bifurcations unattached and in which there can be no resection to allow cleansing of the bifurcation surfaces should be considered hopeless. This applies particularly to upper molar teeth. Teeth that are mobile and move under stress and in which the stress cannot be relieved or counteracted are hopeless. This applies particularly to the third molar when teeth anterior to it are missing. Teeth the presence of which interferes with the satisfactory reconstruction of the dentures should be removed whether or not there is periodontoclasia. The mouth should be relieved of all teeth that cannot be made healthy and that do not contribute to a satisfactory restoration of the dentures.

With healthy teeth to build on, the next problem is one of reconstruction. I shall mention some principles of reconstruction that seem important from a periodontist's standpoint. Where a space exists between teeth and the occlusion is such as to induce adjacent teeth to shift or tip, bridgework should be inserted to prevent further shifting and to brace the tipping teeth. As a periodontist, I favor fixed bridgework over any other type, wherever it is possible to use it. In the case of the lost lower first molar par-

ticularly, it is, I believe, indicated. Removable clasp bridges are, in my opinion, less sanitary and less efficient braces of the teeth than fixed bridges. Neither do they restore the occlusal surface of a tipped lower second molar to a satisfactory occlusal relation. I do not favor a broken stress bridge with a lug on the second bicuspid. In nearly all cases of this type that I have seen, there has been sufficient play of the lug in its seat to prevent the stabilization of the second molar, which is desired. There are methods of so constructing fixed bridges even on teeth that are markedly tipped toward each other that the broken stress bridge is unnecessary. Fixed bridgework is indicated where a lower first molar is missing and the second molar is tipped, even though there be no space between the bicuspid and the molar. Posterior bridgework should not be placed primarily for the purpose of restoring masticating surface, but for the purpose of bracing the teeth against mesial distal stresses and to prevent shifting.

Cantilever bridges are particularly dangerous because the lever action of the cantilever span tends to rock the teeth to which the bridge is attached. They can be used safely only in cases wherein the cantilever pontic is very short and can be disoccluded.

Clasps on bridges or partial dentures should bring no lateral stress on teeth at the time of insertion and removal. Lack of recognition of this principle has been the cause of countless failures with partial dentures. It is a sad commentary on the dentist's knowledge of preventive dentistry and periodontology that he usually regards a partial denture as a stop-gap to loss of all the teeth. When a partial denture is properly constructed, the anchor teeth should become firmer, not looser.

Contacts should be built wherever necessary to prevent food impaction and mesial-distal motion. Occlusal form should be restored by inlays and crowns to reproduce cusps, grooves and curvatures, both lateral and anterior-posterior, so as to equalize the stresses on all the teeth. It should be recognized that teeth of reproduced occlusal form bear far less stress than those in which wide flattened, closely approximating occlusal surfaces exist without sluiceways for food egress.

Cases in which there has been a marked loss of vertical dimension, the so-called closed-bite cases, can often be greatly improved by opening the bite; that is, building up the teeth by crowns and bridgework to higher occlusal levels. If facial dimension is to be increased more than 2 mm., it is often better to perform the operation in stages to permit the adjustments of bone and muscle growth that are required in this procedure. The successive levels are produced by temporary bridge splints, which are simple to make and remove. Bite opening is limited by the fact that excessively long crowns on teeth bring increased leverage on the supporting tissues. When the clinical crown of a functioning tooth is much longer than the root supported by bone, there is danger that the supporting tissues will not withstand the stresses and mobility, and breakdown of the periodontal tissues will result.

A word should be said about orthodontia. I am convinced that a great deal more adult orthodontia could be practiced were orthodontists familiar with periodontia. Were the principles of periodontia to be practiced during treatment by orthodontics, I feel sure that the bone losses and mobility of the teeth and periclasial pockets that orthodontists dread in adult cases could be greatly minimized. On the other hand, many periodontia cases are hopeless without the aid of orthodontics. Until the teeth can be moved into functional occlusal relations,

it may be impossible to relieve the lateral stresses that are causing mobility and deep periclasial destruction. A much closer collaboration between these two branches of dentistry is clearly indicated.

CONCLUSION AND SUMMARY

Periodonticlasia is primarily a local disease due to infection by ordinary mouth bacteria. Accumulation of bacteria, deposition of calculus, food impaction and traumatic stress on the teeth lead to the local breakdown of the investing tissues. Faulty systemic conditions may play a part by lowering cell resistance to bacterial invasion. Periodontoclasia is treated by rendering the tooth surfaces smooth and nonirritating, by keeping the teeth clean and by massage of the infected inflamed tissues. Pockets are obliterated by reattachment of the gingival epithelium lining the pocket to the tooth surface. Food impaction and injurious stress are eliminated by dental procedures designed to establish relations of the teeth to each other that will promote health and prevent disease. Treatment of periodontoclasia involves a knowledge and utilization of nearly all types of restorative dentistry and orthodontia. On the other hand, dental restorative services and orthodontia must depend, in large measure, for their highest success, on the facts and technics developed in periodontology.

THE PREMAXILLA IN MAN*

By M. F. ASHLEY-MONTAGU, New York City

AMONG the bones comprising the human skeleton, there is one bone of importance concerning which our knowledge has for many years been tantalizingly inadequate. It may appear somewhat surprising to some to learn that there remains a bone in the human skeleton the form, limits and relations of which have never been completely determined; yet this is so with respect to the premaxillary bone, or as it is often called in its hominid relation, the intermaxillary bone.

Not only is our ignorance of the anatomy of this bone profound, but the present teaching concerning its form and structure, as provided in the leading textbooks of embryology and anatomy, is, as I shall show, inaccurate and deceptive on points of fundamental importance.

An understanding of the structure, and, more particularly, of the form of this bone, is of considerable importance to those who are in any way concerned with the care of the oral cavity and its immediately related structures. Among others, dentists, stomatologists and oral surgeons have all contributed their share to our knowledge of this bone, and have been among those who have repeatedly urged the necessity of recognizing its importance as the seat and origin of a large variety of disorders affecting the anterior maxillary region. In the present contribution, I hope to make such recognition easier of achievement than has hitherto been possible by providing an adequate though brief description of the premaxilla in man, based essentially upon my own observations.

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*Awarded The Morris Chaim Prize at the New York Dental Centennial Meeting, 1934.

Before proceeding further, it might perhaps be as well to state, for the benefit of those whose knowledge of the subject requires refreshing, what, in a few words, the premaxilla is.

The premaxilla is a bone composed of two bilaterally symmetrical halves, visible on the facial aspect of the skull in all mammals (with the exception of man),

Fig. 1.—Papio hamadryas; in norma verticalis, showing well-developed premaxillary bone upon facial aspect of the skull.

and situated at the sides of, and below, the pyriform aperture of the nasal fossa, and between the maxillary bones. It forms the entire part of the anterior division of the palate, the anterior and lateral portions of the incisive foramen, and gives passage to the foramina of Scarpa and Stenson. Finally, it forms the anterior part of the floor, and the lateral nasal walls, of the nasal fossa, and assists in the support of the four incisor teeth of the upper jaw.

COMPARATIVE ANATOMY

The premaxilla is one of the oldest elements of the skull. It is found as a

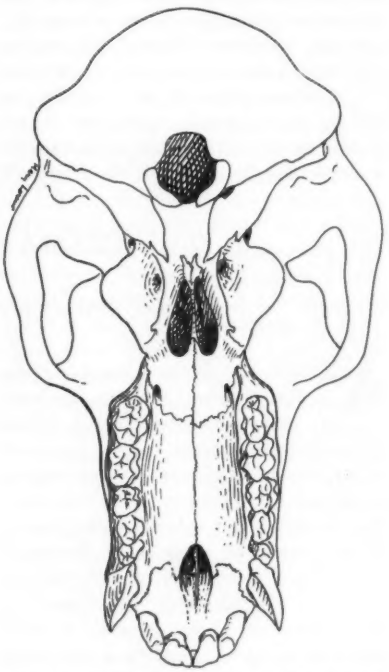

Fig. 2.—Papio hamadryas; in norma basilaris, showing form and relations of premaxilla on palatine aspect of skull anteriorly. (Skull shown in Figure 1.)

well-developed bone in fishes and amphibia, reptiles, some protomammals and all mammals, with the exception, according to Walter,[1] of certain bats and eden-

1. Walter, H. E.: Biology of Vertebrates, New York: The Macmillan Co., 1929, p. 541.

tates. In all cases, the premaxilla gives lodgement to the roots of the incisor teeth.

A brief description of the form of the premaxilla in two widely separated animals of the order of mammals of which man is a member, the Primates, namely, the dog-faced baboon *Papio hamadryas,* an Old World monkey, and an anthropoid ape, *Gorilla gorilla,* may now be attempted in order to provide something of a background for our understanding of the present status of the premaxilla in man.

Fig. 3.—Gorilla gorilla; in norma frontalis, showing premaxillary bones and sutures on facial aspect of skull.

In Figure 1 is portrayed, in norma verticalis, a view of the skull of a baboon (*P. hamadryas*). It will be observed that this creature possesses a very elongate snout, much as in certain dogs. It is for this reason often spoken of as a *Cynomorph,* formed like a dog. The snout is formed by two bones, the maxilla and the premaxilla. The premaxilla, it will be seen, forms quite a considerable part of the snout, in this specimen being wedged, superiorly, between the maxilla and the nasal bones, and, inferiorly, broadly splayed, carrying the four incisor teeth, and forming the whole of the considerable bony diastema (for the reception of the mandibular canine, which articulates in front of the maxillary canine) between the lateral incisor and the canine. This is an important point to bear in mind. It should be noted that the suture which separates the maxilla from the premaxilla, the premaxillary suture, terminates practically flush against the proximal surface of the canine tooth. This relationship is of importance in considering the various conditions presented in this region in certain forms of cleft palate, and in certain conditions in which there is a congenital absence of teeth normally situated in this vicinity.

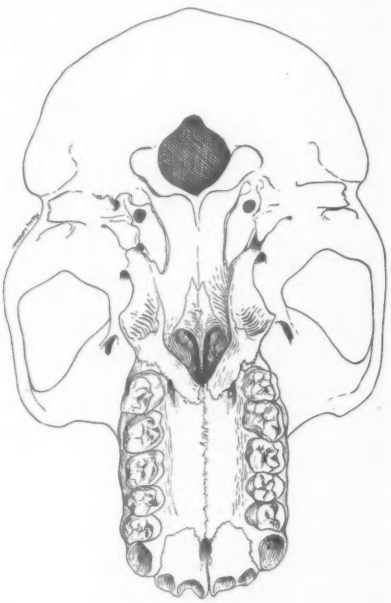

Fig. 4.—Gorilla gorilla; in norma basilaris, showing palatine aspect of premaxilla. (Skull shown in Figure 3.)

In Figure 2 is presented a view of the same skull, in norma basilaris, showing the palatal aspect of the premaxilla. It will be observed that the premaxilla here forms not only the whole of the anterior part of the palate, but also the whole of the incisive or nasopalatine foramen and its canals. On this aspect, the bony diastema between the lateral incisor and canine is clearly visible.

This baboon has been selected in order to illustrate the form of the premaxilla on its external aspects; first, because it serves as a good generalized example of the form of this bone in the mammalia as a whole; secondly, because its appreciable size, extent and relationships very clearly serve to emphasize the changes in form which this bone has undergone in the evolution of man, and, thirdly, because it serves to point some of the reasons for these changes.

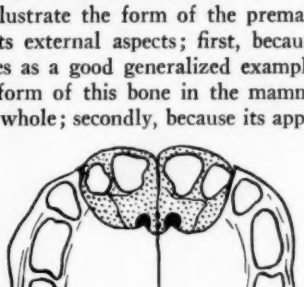

Fig. 5.—Human palate at birth. The stippled area represents the premaxilla. (After Sir Arthur Keith, p. 195, Fig. 187.)

In Figure 3 will be seen the frontal aspect of a collateral relative of man, the gorilla. From this view, it will be seen that the snout region is much less considerable than in the baboon. Nevertheless, the premaxilla forms quite an appreciable part of the face. There is not so much wedging of the bone between the nasal and maxillary bones as in the baboon, and the bone is actually both absolutely and relatively smaller than in the baboon.

On its palatal aspect (Fig. 4), it will be observed that the premaxilla is also comparably smaller, not forming so large a part of the palate as in the baboon; nor is the diastema between the lateral incisor and the canine so great. The premaxillary suture maintains the same relationship to the canine here in the gorilla as in the baboon. This relationship holds good for all mammals.

In man, the premaxilla is so reduced an element that, as late as the year 1858,[2] after three centuries of labor, and more than two hundred studies had been devoted to this particular bone in man and mammals, its existence as a normal structure in the skull of man was denied. The original difficulty, it appears, began in the second century A.D., when Galen[3] described premaxillary suture lines on the facial aspect of the human skull precisely as they exist in monkeys. This was the accepted teaching until 1543, when Vesalius[4] showed conclusively that this was not the case. Vesalius was soon contradicted by his one-time master in anatomy, Jacobus Sylvius, of Paris,[5] who could find no better argument with which to refute Vesalius than to heap abuse upon his head and to malign him. Vesalius was enthusiastically supported by his pupils, Columbus,[6] and Falloppius,[7] and by the anatomists of the fol-

2. Rousseau, E.: De la non-existence de l'os intermaxillaire chez l'homme a l'etat normal, Compt. rend. de L'Acad. d. Sc., 47:46, 176, 260, 1858-1859.

3. Galen, C.: De natura ossium, Paris: 1550, p. 14.

4. Vesalius, A.: De humani corporis fabrica, Book 1, Basel: 1543, p. 36-43.

5. Sylvius, J.: Vaesani cuiusdam calumniarum in Hippocratis, Paris: 1551.

6. Columbus, R. C.: De re anatomica, Book 1, Basel: 1559, p. 30.

7. Falloppius, G.: Observationes anatomica, Venice: 1561, p. 35.

lowing century who at all concerned themselves with this subject, notably, Ingrassias,[8] Riolan[9] and Tyson.[10] In the eighteenth century, in spite of Nesbitt's description of the premaxilla in a human fetus of between 3 and 4 months, in 1763,[11] some doubt arose as to the existence of this bone in man. Blumenbach[12] and Camper[13] claimed never to have observed it in man, though Blumenbach[14] later acknowledged its existence. In the year 1780, the great French comparative anatomist Vicq D'Azyr successfully demonstrated the premaxilla in adult man, and, for the first time in the history of the subject, stated its structural equivalence, or homology, to the same bone in lower animals.[15] This discovery is generally accredited to Goethe,[16] who actually published his study on the same subject about six years after the appearance of Vicq D'Azyr's work; that is, in 1786. Goethe's conduct in not acknowledging his indebtedness to Vicq D'Azyr's work, with which he was undoubtedly acquainted, is somewhat difficult to understand. This is a matter which has recently been most ably treated by Franz,[17] to whose work the reader may turn for a discussion of the subject. Despite Vicq D'Azyr's demonstration, and Goethe's description of the premaxilla in man, the fate of the premaxillary bone seemed to hang in the balance. Was it to be or not to be? Sir William Lawrence, distinguished surgeon and comparative anatomist, in 1807[18] and subse-

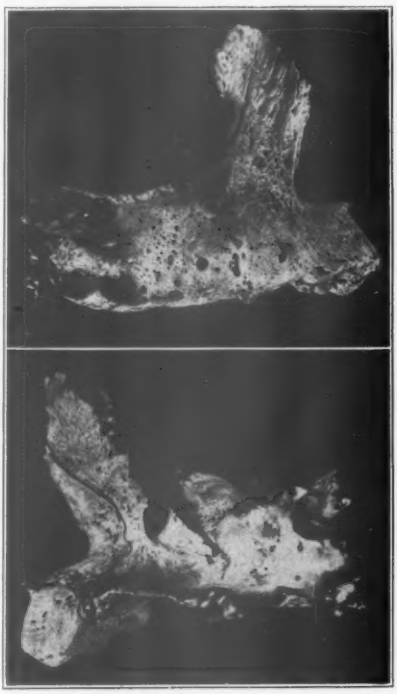

Fig. 6.—Above: Facial aspect of premaxilla in a male negro fetus at term. Below: Endofacial aspect of same bone.

8. Ingrassias, L.: Commentarii in Galenii librum de ossibus, Palermo: 1603.

9. Riolan, J.: Anatome corporis humani, Paris: 1610, pp. 48-50.

10. Tyson, E.: Orang-outang, sive Homo sylvestris, London: 1699, p. 68.

11. Nesbitt, R.: Human Osteology, London: 1736, p. 195.

12. Blumenbach, J. F.: De generis humani varietate nativa, Göttingen, 1776, pp. 33-34.

13. Camper, P.: Kurze nachricht von der verschiedener orang utangs, Kleinere schriften, 1:(Pt. 2) 93-94, 1778.

14. Blumenbach, J. F.: Manual of Comparative Anatomy, London: 1807, pp. 17-19.

15. D'Azyr, Vicq F.: Observationes anatomiques sur trois singes, etc., Hist. de L'Acad. Roy. d. Sc. de Paris, 1780, pp. 478-493.

16. Goethe, W.: Dem menschen wie den thieren ist ein zwischenkiefer den oben rinnlade zuzuschreiben, Jena: 1786.

17. Franz, V.: Goethes zwischenkieferpublikation nach Anlass, Inhalt und Wirkung, Ergebn. d. Anat. u. Entwckingsgesch., 30, 469-550, 1933.

18. Lawrence, W.: Additional notes to translation of Blumenbach's Manual (Footnote 14).

quently in 1844, [19] denied unqualifiedly the existence of the premaxilla in man, saying that he really could not understand how it came about that so able an anatomist as Vicq D'Azyr had given a description of a bone which, in Sir William's particular universe, had no real existence. About five years later, Joseph Leidy, of Philadelphia, gave an exceptionally clear demonstration of the existence of the premaxilla in man by describing the separated bone in a human fetus of 9 to 10 weeks, describing, at the same time, parts of the premaxilla visible on the facial aspect in two additional fetuses.[20] This beautiful demonstration passed altogether unnoticed, that is to say, as far as European anatomists were concerned, owing, it must be assumed, to the obscurity of the journal in which it was published. In 1858, Bryant[21] gave the first description of necrosis of the premaxilla in man, a condition which has since been frequently reported. It was not until 1869 that what in many ways still remains the most excellent account of the developmental anatomy of the premaxilla in man was given. This was a work by G. W. Callender published in the *Philosophical Transactions of the Royal Society,* London.[22] From this time on, there could no longer be any doubt concerning the existence of the premaxilla in man, and the numerous studies which have appeared in connection with it have since done much to enhance our knowledge of this veritable bone of contention. It remains true that our knowledge concerning the premaxilla is far from being complete or satisfactory. Moreover, on certain essential and important points, we remain completely ignorant, and, what is worse, misinformed. These matters I hope to make clear in what follows.

Fig. 7.—Skull of white infant, aged about 11 months; showing apical portion of premaxilla separted from maxilla. On the endofacial aspect, the premaxilla and its suture are clearly visible in their entirety.

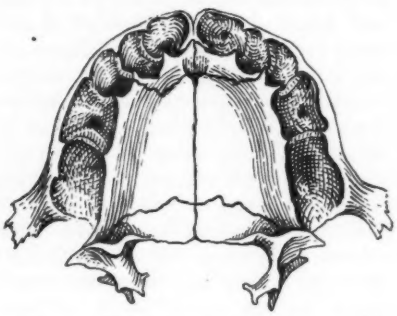

Fig. 8.—Palatine view of skull of white female infant aged 7.26 months; showing production posteriorly of incisor processes of maxilla to meet premaxilla, and beginning development of distal walls from maxilla of incisor sockets.

19. Lawrence, W.: Lectures on Comparative Anatomy, London: 1844, pp. 119-120.

20. Leidy, J.: Existence of Intermaxillary Bone in Embryo of Human Subject, Proc. Acad. Nat. Sc., Philadelphia, 5:145-147, 1849.

21. Bryant, T.: Necrosis of Intermaxillary Bones, Tr. Path. Soc. London, 1858-1859, pp. 216-217.

22. Callender, G. W.: Formation and Early Growth of Bones of Human Face, Philosophical Tr., 1869, pp. 163-172.

DEVELOPMENT OF THE PREMAXILLA IN MAN

Each half of the premaxilla develops in the mesial nasal process through the agency of an independent center of ossification, which appears during the latter part of the seventh week of development, shortly after the appearance of the maxillary centers. The premaxillary centers appear in the midline of the mesial nasal process just below the center for the vomer. With the commencement of the ossificatory process, a number of premaxillary structures make their appearance and in the following order: (1) a keel for the reception of the anterior-inferior portion of the vomer; (2) the anterior

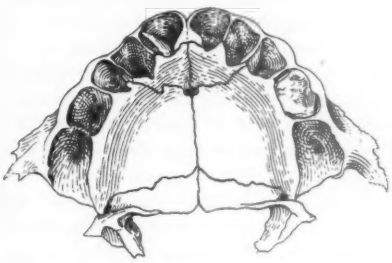

Fig. 9.—Palatine view of skull of a negro male fetus, aged 9.27 months; showing maxillary-premaxillary relationships.

floor of the nasal fossa; (3) the anterior nasal spine; (4) the ascending processes which form the walls and lateral borders of the pyriform aperture endofacially, and (5) the palatine processes forming the anterior part of the palate, the median septum and the anterior and lateral walls of the incisive or nasopalatine foramen.

Between the twelfth and the fifteenth weeks, the lateral maxillary processes extend over and across the ascending processes of the premaxilla above, and below meet in the midplane in what is commonly termed the intermaxillary suture. From this junction, the maxillary processes proceed to grow backwards in the midplane and, meeting the medial maxillary process of the premaxilla on the lateral aspect, proceed to diverge slightly laterally to form part of the posterior palatal border of the central incisor teeth.

This brief, bare and rather general description of the development of the premaxilla possesses one merit: it may be easily remembered. As it stands, it is not quite adequate; and, in order that it may be more thoroughly understood, it requires the sort of elaboration which I now propose to give it, and which will, it is to be hoped, make clear the inaccuracies of existing accounts of the form and structure of the premaxilla. In writing thus, I am most anxious not to give the appearance of detracting in any way from the work of my predecessors in this field. Such exemplary studies of the development of the premaxilla as have been made in recent years, particularly those of Peters[23] and his pupil Jarmer,[24] not to mention numerous others, deserve the most unstinted praise. If omission is a fault, it is the fault of these studies that they have not been carried quite far enough.

If, for example, we examine the most recent, as it is undoubtedly the most readable and among the most excellent of human embryologic texts, Sir Arthur Keith's "Human Embryology and Morphology" (1933),[25] we find the following description of the premaxilla:

The two premaxillary bones form the sockets of the four upper incisor teeth. At birth the suture between the premaxilla

23. Peters, K.: Die formale genese der gesichtsspalten, Vierteljahrsschr. f. Zahnheilk., 4, 1921.

24. Jarmer, K.: Ueber die mehrfache anlage des zwischenkiefer beim menschen, Ztschr. f. Anat. u. Entwickingsgesch., 64:56-76, 1922.

25. Keith, Arthur: Human Embryology and Morphology, Baltimore: William Wood and Co., 1933, pp. 189-190.

can be seen on the hard surface. . . . On the facial aspect, the suture between the premaxilla and maxilla disappears very soon after separate centres of ossification have appeared for these two bones. The centres appear late in the 7th week. The nasal spine is formed by the premaxillae. The median or septal processes of the premaxillae represent the prevomers which are seen as distinct bones in the primitive palate of amphibia. Prof. Fawcett[26] found that these processes have separate centres of ossification in man.

In mammals generally the premaxillae are highly developed, separated throughout their whole extent by a suture from the maxillae, and form the snout part of the face. In higher primates the face becomes less elongated, less *prognathous*, or projecting, and the premaxillae less developed. In the orang, for instance, the premaxillary sutures are distinctly seen on the face at birth, but as the permanent canines begin to develop they fuse with the maxillae. The premaxilla is more reduced in man than in any other primate; in him it is partly fused with, and overlapped by, the maxilla almost from the first appearance of the two centres of ossification; in apes fusion does not occur until the eruption of the permanent teeth. The vestigial character of the premaxilla in man is due to the reduced size of his masticatory apparatus and the consequent retrogression in the development of the facial part of the skull. The reduction of the premaxillary element alters the size of the nasal aperture.

This description, which is one of the best in the literature, is accompanied on another page by a diagram, which has here been reproduced as Figure 5. Both the description and the figure convey the impression that the premaxilla is present anteriorly, or that its anterior wall is, below the level of the pyriform aperture, and that the difference between it and the same bone in the apes lies merely in the fact that the premaxilla in man is partly fused with and overlapped by the maxilla; whereas, in the apes, it is not so overlapped, fusion taking place only at the premaxillary suture on the face. Such, indeed, is the inference to be drawn from all existing descriptions of the premaxilla in man. Moreover, Sir Arthur's figure definitely conveys the impression, which is supported in his text, that the incisor teeth have their sockets formed entirely by the premaxilla, both anteriorly and posteriorly. This, in fact, represents the contemporary view of the matter. In reality the facts are otherwise.

In order to arrive at a proper conception of the evolutionary changes which have led up to and resulted in the peculiar form of the premaxilla in man, 9,947 primate crania were examined, ranging in age from birth to adult life. Of these, 5,277 were crania of subhuman primates, and 4,670 were of human beings; the first number comprising members of the majority of primate genera, and the second consisting of forty-two of the less frequently reported on races of mankind. In addition, 100 fetuses ranging in age from 3 months to term were also examined, fifty being of white origin and the remaining fifty of negro origin. Thus, the total number of specimens here reported on number 10,047.

In the subhuman primates, it was found that the premaxilla is correlated with the length or anterior projection of the snout: the longer the snout, the larger the size of the premaxilla, and vice versa. Not only this: it was found that the period at which the premaxillary suture tends to undergo obliteration is correlated with the size of the premaxilla. Where, for instance, the premaxilla is small, the tendency, with few exceptions, is for the premaxillary suture to undergo obliteration earlier than in those animals with large premaxillae. In the

26. Fawcett, E.: J. Anat., 40:400 (quoted by Keith, Footnote 25).

human fetuses examined, the same rule was found to hold good. Thus, negro fetuses, which are distinctly more prognathic than white fetuses, show a strong tendency for the premaxillary suture to remain unobliterated for an appreciably greater period of time than in the more orthognathic white fetuses.

As we proceed from the lower to the higher primates, a gradual reduction in size of the snout is observed, with an accompanying reduction in the size of the premaxilla. In all cases, the premaxilla and its suture lines are visible on the facial aspect of the skull, with the exception, it is generally held, of man, in whom it is said that the premaxilla is never visible on the facial aspect of the skull, and in whom all traces of the premaxilla on the facial aspect are obliterated as early as the third fetal month. This is not quite true, for I have observed portions of the premaxilla on the facial aspect of the human skull in 7.2 per cent of the negro fetuses, and 1.6 per cent of the white fetuses examined by myself. Moreover, portions of this bone may occasionally be seen on the facial aspect of human crania as late as the fifth year, after which they become so completely identified with the maxilla that they cannot be distinguished from it. These portions of the premaxilla may, in such cases, be identified at the apex of the premaxilla where the latter meets the nasal bone at the superior lateral angle of the pyriform aperture. (Figs. 6-7.) Below the level of the anterior-inferior border of the pyriform aperture, traces of the premaxilla or its suture are never present on the facial aspect of the skull, and it is chiefly in this respect that man differs from all other animals. What, we may well inquire, is the reason for this difference? And what, we may further ask, is the condition of the premaxilla in man below the level of the pyriform aperture in man? Is the premaxilla essentially the same in form as in the gorilla, differing from it only in that it is overgrown by the lateral maxillary processes? Or are the differences somewhat greater than this? With the answer to these questions, we shall now proceed.

The assumption has hitherto been that the premaxilla in man retains a form similar to that which is seen in the gorilla, with the difference only that while in the gorilla, as in the majority of the primates, the premaxilla remains apparent on the face and loses its independence only by becoming united with the maxilla at its junction with that bone, in man, on the other hand, the premaxilla becomes completely overgrown by the maxilla, not a vestige of any sutural junction with the maxilla remaining on the face. It has already been shown that the latter assumption is not quite accurate. It has now to be shown that the form of the premaxilla in man is no longer the same as it is in any other primate, though, as we shall presently see, there can be little doubt that the human premaxilla is derived from an anthropoid type of premaxilla.

The points to be established may best be described from the skull of the late human fetus.

If the facial aspect of the skull below the pyriform aperture in a fetus of about 7 months is carefully examined, it becomes quite clear that the bone presented to the eye in that situation is formed by the maxilla, no trace of the premaxilla being visible. It may thus be established that whatever the form of the premaxilla may be beneath, the maxilla lies in front of it, overlying it. If now we slowly turn the skull so that we are enabled to view the palate, carefully following the external alveolar border of the maxilla anteriorly as we do so, it will be observed

that the two halves of the maxilla do not coalesce with one another in the median plane, nor do they meet in any sutural relationship, but that there is merely a division between the two bones which, as has already been remarked, is not properly a suture. As we follow the external alveolar borders to the midplane, it will be observed that, at that point, they describe a sharp curve of about 190 degrees, passing medially and posteriorly to the eventual situation of the central incisor teeth. These processes, which may be called the incisor processes of the maxilla, continue posteriorly until they come in contact with the median palatine processes of the premaxilla, at which point they again perform a curve, but this time to pass laterally apparently for a distance extending to about one third of the posterior wall of the central incisor socket, to terminate in a slight tuberosity. (Fig. 8.) Looking within the socket, one may observe that this tuberosity actually constitutes the inferior limit of an incomplete septum which lies anterior to and is separated from the posterior alveolar wall, and which, together with a similar septum, which originates from the posterior extremity of the lateral incisor septum (both in the fresh condition of being completed by a membrane of fibrous tissue), enclose an appreciable space, which is entirely devoted to the germ of the permanent incisor tooth. This transverse septum is derived from the maxilla medially and from either the premaxilla or the maxillary incisor septum laterally. Anteriorly to this septum lies the developing crown of the deciduous central incisor, which is clearly completely surrounded by maxilla. Posteriorly to this transverse septum lies the germ of the developing permanent central incisor, which, but for its anterior wall, the transverse septum, is lodged entirely within the premaxilla. With the eruption of the permanent tooth, this septum becomes entirely resorbed and the tooth comes to lie in a socket which is formed anteriorly, medially and, to some extent, laterally, by the maxilla, and only the lateral two thirds or three fourths of the posterior wall of which is formed by the premaxilla. Anteriorly, except for the anterior nasal spine, there is no trace of the premaxilla whatsoever, it having been completely absorbed by the maxilla, and were it not for the fact that we possess the descriptions of Nesbitt,[11] Leidy[20] and Ranke of fetuses between the tenth and twelfth weeks of development showing the presence of the premaxilla below the pyriform aperture separated from the maxilla by suture lines precisely as in the apes, we might well doubt the existence of the anterior wall of the premaxilla at any stage in the development of man. Actually, after the third month of development, the premaxilla below the pyriform aperture completely disappears in the substance of the maxilla, and, in this relation, ceases to be present either as an independent lamina of bone or as a part of such. Not only does the maxilla, therefore, form the anterior wall of the incisor sockets, but it also forms the whole of the median alveolar septum, which extends between the central incisor sockets and actually forms their median walls, and, in addition, forms a considerable portion, at least, of the transverse septum, which separates the developing deciduous from the developing permanent central incisor. It seems evident, then, that, in man, the anterior wall of the premaxilla has been completely lost, appearing transitorily only between the tenth and twelfth weeks of development, after which it is completely absorbed and its place and function are entirely assumed by the maxilla. In addition, it is to be observed (Figs. 8-9) that by far the largest portions of the distal septal walls of

the incisor sockets are formed by the maxilla and not by the premaxilla. The posterior wall of the permanent central incisor sockets is, with the exception of the medial third, which is formed by maxilla, formed by the premaxilla. The same holds good for the lateral incisor walls, but the medial septal wall of the latter sockets are formed almost entirely by the maxilla. This is true, too, of the canine distal septal wall. these facts are clearly shown in Figures 8 and 9.

Thus, it would appear that statements to the effect that the premaxilla lodges the incisor teeth in man are inaccurate; for it has been shown that, in man, it is only the posterior portion of this bone which assists in the lodgement of these teeth, and that anteriorly and medially the premaxilla has been entirely replaced by the maxilla.

Upon the basis of these findings, it at once becomes clear why facial premaxillary suture lines are never observed below the level of the pyriform aperture in man. The reason is simply that they have already ceased to exist by the end of the third fetal month, having been completely obliterated by proliferations of ossificatory material originating in the maxilla. The premaxilla below this level in this situation has been entirely lost in man, being replaced by the maxilla. Thus, man is, in this respect, unique, that, of all animals possessing incisor teeth, he alone is the animal in which the anterior walls, which together with the posterior and lateral walls normally assist in the support of these teeth, are formed by the maxilla and not by the premaxilla, as is the case in other animals. In fact, each of the four incisor sockets is, in man, almost entirely formed by the maxilla; whereas, in all other animals, these sockets are clearly formed entirely by the premaxilla. Thus, it becomes evident that the premaxilla has, on all sides, been almost completely replaced by the maxilla, and that only an abbreviated portion of the original bone now exists in the human skull, on the palatine aspect orally, on the anterior part of the floor of the nasal cavity and on the walls internally, bordering the pyriform aperture laterally.

The existence of these interesting differences in the relations and structure of the maxillary and premaxillary bones between man and his subhuman relations leads to the question of etiology.

A brief consideration of the form of the face in the primates leaves little room for doubt that the chief factor in this unique change in the maxillo-premaxillary relationship in man has been the progressive and almost total reduction in the length and size of the snout. The premaxilla, which in the lower mammals and primates forms an appreciable part of the produced snout, has, in man, been so completely retracted that it may be said to have been almost totally embraced by the face, the maxillary bones forming an operculum over it. Writing recently on the classification of the upper lip in mammals, Boyd (1933)[27] makes some interesting remarks in this connection:

> The main factor causing the relative and absolute increase in the maxillary contributions to the face would appear to be the decline in importance of the "oral sense" and the olfactory apparatus. This diminution in the importance of olfaction can be correlated with the decrease in the development of the fronto-nasal process, the maxillary processes becoming progressively more prominent in the formation of the definitive face. Another factor that may have had an influence on the process of substitution of maxillary processes for the fronto-nasal process is the marked increase

27. Boyd, J. D.: Classification of the Upper Lip in Mammals, J. Anat., 67:409-416 (April) 1933.

in the mobility of the lips in the higher Primates.

That the mobility of the lips in the higher primates has been a factor in the reduction of the frontonasal process seems open to doubt, but that a strong oral and olfactory sense is generally accompanied by a pronounced snout is a well-established fact. The inference seems to be obvious that, with the decrease in the importance of the oral and olfactory senses, and the increase in the importance of the visual sense, there would be, among other things, a concomitant diminution in the visceral-osseous apparatus associated with the oral-olfactory senses, an important part of which is formed by the premaxilla. This diminution would express itself in a decrease in the length and size of the snout, tending toward a facial orthognathism. With the decrease in the importance of the rôle played by the oral and olfactory senses in the life of the animal, the smaller the relative size of the premaxilla and the more reduced the snout would become. In addition to this, there is the important factor represented by the teeth, particularly the canine-maxillary developmental relationships. If, for example, we examine the skull of an adult Catarrhine monkey, such as that seen in Figures 1 and 2, namely *Papio hamadryas,* in the anterior dental region, it will be observed that a very large diastema exists between the lateral incisor and the canine teeth. This diastema exists for the reception of the saber-like mandibular canine, and is almost entirely formed by the premaxilla. In the *Hylobatidae,* the gibbons, an even larger diastema exists for the reception of the tusklike mandibular canine. In the orang-utan, in which the canines are relatively reduced, a smaller diastema exists between these teeth. In the chimpanzee, in which the canines are still further reduced, a smaller diastema exists. In the gorilla, in which the mandibular canine in the male is extremely large and tusklike and appreciably larger than in the female, the diastema is relatively large, and below, in the mandible, there is an equivalent diastema for the accommodation of the maxillary canine. With a reduction in the size of the canines, such as has taken place in man, such a diastema would no longer serve any useful purpose, and would therefore undergo a process of contraction. This process, in man, actually takes the form of a reduction in the posterolateral portions of the premaxillae, which, in the subhuman primates, provides the structural basis for the diastema. In this manner, we may account for the disappearance of the posterolateral portions of the premaxilla in man.

That this account of the factors in the reduction of the premaxilla in man corresponds to the facts, the available evidence seems strongly to attest. In the light of these facts, the comparatively great differences in the size, form and relations of the premaxilla which exist between man and other mammals, particularly the anthropoid apes, are easily understood. It is quite clear that the human premaxilla must once have passed through a stage such as that in which the anthropoids now are, and, indeed, it is only possible to understand the peculiar changes which have taken place in the human premaxilla on the assumption of its being derived from such a type as is now characterized by the anthropoids.

From all these facts, it seems reasonable to conclude that the premaxilla in man has undergone a progressive reduction with loss of function, and that this reduction is going on at the present time. Since the premaxilla no longer serves any useful function, it is doomed to extinction. Nevertheless, though much reduced,

the premaxilla still plays a certain rôle in the economy of the human head, and disturbances in its development, growth and nutrition may have serious consequences.

DISORDERS AFFECTING THE PREMAXILLA

Cleft Palate and Harelip.—Cleft palate is a disorder which originates during the process of embryonic development, and, in fact, always has its initiation before the appearance of the ossificatory centers for the maxilla or the premaxilla; that is, before the seventh week of development. The cleft does not follow the line of sutural junction between maxilla and premaxilla, but actually passes through the body of the premaxilla, generally dividing the dental lamina across the site of the lateral incisor tooth, so that the latter frequently develops as two distinct and generally malformed portions of the single tooth, and part of the premaxilla with a portion of such a tooth lodged in it generally appears on the lateral side of the cleft.

The varieties of harelip are due to developmental defects arising in the mesial nasal process, involving, primarily, the premaxilla, on one or both sides.

It has been suggested by Herbst and Appfelstaedt (1930),[28] in whose excellent work a detailed treatment of the etiology of these conditions will be found, that these defects are an expression of the strong retrogressive trend of the mesial nasal process in man. In this view, I fully concur.

Congenital Absence of the Premaxilla.—This condition has been reported in one instance only, in a dried skull.[29] As the evidence is questionable, it is by no means certain whether the premaxilla was lost after birth or failed to develop altogether. An examination of the literature reveals no case of so-called congenital absence of the premaxilla which would bear examination. There is no reason that the condition could not occur, but it appears to be of extreme rarity.

Necrosis and Exfoliation of the Premaxilla.—Necrosis and exfoliation of the premaxilla have been reported in numerous instances.[30] In children, the condition sometimes occurs during convalescence from one of the eruptive fevers, such as scarletina or measles, when the whole or part of the premaxilla may slough away or become detached from the maxilla, together with the incisor teeth, the subpyriform portion of the maxilla being always involved in these affections. In adults, syphilis may exercise a similar local effect on the premaxilla.[31]

Hypoplasia of the Premaxilla.—This

28. Herbst, E., and Appfelstaedt, M.: Malformations of Jaws and Teeth, New York: Oxford University Press, 1930, p. 118.

29. Fischel, A.: Ueber einem menschlichen schadel ohne zwischenliefer, Anat. Anz., 27: 561-575, 1905.

30. Salter, J.: Exfoliations of Portions of Maxillary Bones with Contained Teeth, Tr. Path. Soc. London, 40:209-215, 1860. Jackson, H.: Exfoliation of One of Premaxillary Bones After Measles, M. Times & Gaz., 2:681-682, 1862. Bryant, T.: Exfoliation of Intermaxillary Bones of Adult, Lancet, 2:153, 1884. Hamy, E.-T.: L'os intermaxillaire de l'homme a l'etat normal et pathologique, Thèses de Paris, No. 250, 1868, pp. 1-86. Frison, M. L.: De la necrose de l'os intermaxillaire, Thèses de Paris, 1901, pp. 1-120. Jeffery, L.: Absence of Intermaxillaries, Brit. D. J., 25:(N. S.) 501-503, 1904. Walker, C.: Absence of Premaxilla, J. Anat. & Physiol. 51:392-399, 1917. Richardson, C. W.: Syphilitic Necrosis of Intermaxillary Portion of Superior Maxilla, Laryngoscope, 27:605 (June) 1918. Bercher, J.: Cause occasionelle de la necrose de l'os intermaxillaire, Paris méd., 2:190-191 (Sept. 6) 1924.

31. Bercher, J., and Merville: Deux cas de syphilis tertiare de la region incisive superieure, Rev. de Stomatol., 25:198-204, 1923; Deux nouveaux cas de necrose de l'os intermaxillaire chez heredo-specifiques, ibid., 25: 414-417, 1923.

condition is, of course, a reflection of the general retrogressive trend of the premaxilla in man. In accordance with the degree of hypoplasia, this condition may result in (1) complete or partial absence of the incisor teeth, (2) the reduction in size of some or all of the incisor teeth (and thus congenital absence or dwarfing of the lateral incisors may be attributed to this condition), (3) eversion of the canine, with contact of the lateral incisor and first premolar, (4) twisting and tilting of the incisors, (5) decrease in the breadth of the nose, with crowding of the nasal septum, (6) decrease in the interorbital breadth and (7) shortening of the upper lip.

Congenital absence and reduction of the lateral incisors are conditions which occur in a few groups of subhuman primates as well as in man, but nowhere do these conditions occur as frequently as in man, in whom these conditions are properly to be regarded as the result, at least partially, of the fact that the region in which these teeth normally develop, namely, the posterolateral portions of the premaxilla, represent areas of great instability in consequence of their progressive and intensive reduction.

Hyperplasia of the Premaxilla.—Hyperplasia of the premaxilla, a little understood condition, seems in most instances to be preceded by an inflammatory process. It may result in (1) the creation of a considerable diastema between the central incisors and excessive growth of the frenulum labii superioris, (2) a more or less excessive projection of the premaxilla or its substance anteriorly to the maxilla, either with or without clefts, and (3) more or less excessive deflection of the nasal septum.[32]

32. Literature consulted, but not cited in this paper:

Albinus, B. S.: De ossibus corporis humani, Leyden: 1737, pp. 53-61.

Fischer, G.: Ueber die verschiedene form der intermaxillarknochens in versciedenen thieren, Leipsic: 1800.

Rosenmueller, J. C.: Dissertatione de singularibus et nativis ossium corporis humani varietatibus, Leipsic: 1804, p. 14.

Meckel, J. F.: Manual of Descriptive and Pathological Anatomy, London: 1838, p. 67.

Leuckart, K. G.: Untersuchengen über das zwischenkieferbein das menschen, Stuttgart: 1840.

Humphry, G. M.: Treatise on Human Skeleton, Cambridge: 1858, pp. 182, 283.

Cleland, J.: Relations of Vomer, Ethmoid and Intermaxillary Bones, Proc. Roy. Soc. London, 11:163-166, 1861.

Lewes, G. H.: Life of Goethe, London: 1864, pp. 345-350.

Vogt, C.: Lectures on Man, London: 1864, pp. 147-148.

Smith, J.: Certain Points in Morphology of Cleft Palate, Proc. Roy. Soc. Edinburgh, 5: 575-578, 1866.

Eudes-Descongchamps, J. A.: Remarques sur l'os intermaxillaire chez l'homme, Bull. Soc. Linn. de Normandie, 10, 1866.

Larcher, J. F.: Contribution a l'histoire de la rhinocephalie et des os intermaxillaire dans l'espece humaine, J. L'Anat. et de Physiol., 5:167-177, 1868.

Broca, P.: L'Ordre des primates, Bull. Soc. D'Anthrop. de Paris, 4:228-401, 1869.

Sappey, P. C.: Traite d'anatomie descriptive, 1:214-218, 1876.

Albrecht, P.: Sur les quatre os intermaxillaires, Bull. Soc. d'Anthrop. de Bruxelles, 1882, pp. 73-95.

Kolliker, T. H.: Ueber das os intermaxillaire des menschen, Nova Acta der Leopold. Carol. Akad der Naturforsch., Halle, 43:327-395, 1882.

Allen, H.: System of Human Anatomy, Philadelphia: 1882, pp. 134-135.

Turner, W.: Relation of Alveolar Form of Cleft Palate to Incisor Teeth and Intermaxillary Bones, J. Anat. & Physiol., 19:198-213, 1884.

Bland-Sutton, J.: Parasphenoid, vomer and Palato-Pterygoid Arcade, Proc. Zool. Soc. London, 1884, pp. 566-573.

Berard, L.: L'os intermaxillaire, Thèse de medecine de Montpellier, 1888.

Kolliker, T. H.: Ueber zwischenkiefer, Anat. Anz., 3:577-579, 1888.

Biondi, C.: Ueber zwischenkiefer, Anat. Anz., 3:577-579, 1888.

Gilis, E.: Sur l'intermaxillaire, Bull. decla Soc. Anatomique, Ser. 5, 2:372-374, 1888.

Allen, H.: Hyperostosis of Premaxillary Portion of Nasal Septum, M. News, Philadelphia, 57:183-186, 1890.

Ranke, J.: Ueber den zwischenkiefer, Cor.-Bl. Anthrop. u. Ethnol. u. Ergesch., No. 9, 1901, pp. 96-102.

Rabl, C.: Die Entwicklungsgeschichte des gesichtes, Leipsic: 1902.

Le Double, A. F.: Traite des variations des os de la face de l'homme, Paris, 1908, pp. 244-261.

Preiswerk, P.: Die rolle des zwischenkiefers bei der bildung von zahnen und kiefer-anaomalien, Deutsche Monat. f. Zahnheilk., 1908.

Mosher, H. P.: Influence of Premaxillae upon Form of Hard Palate and upon Septum, D. Items Int., 31:481-515 (July) 1909.

Fawcett, E.: Development of Human Maxilla, Vomer and Paraseptal Cartilage, J. Anat. & Physiol., 45:378-406, 1911.

Bruni, A. C.: Studio sullo sviluppo della regione intermascellare nell'uomo, Atti. d. R. Acad. Sc. di Torino, 47:154-156, 1911-1912.

Frets, G. P.: Beitrage zur vergleichenden anatomie und ontogenie der nase der primaten, Morphol. Jahrb., 44:409-461, 1912.

Inouye, M.: Der zwischenkiefer, u. z. w., (Anatomy), 45:475-610, 1912.

Bolk, L.: Ueber die obliteration der nahte am affenschadel, u. s. w. Ztschr. f. Morphol. u. Anthrop., 15:1-206.

Wood-Jones, F.: Problem of Man's Ancestry, London: 1918, p. 36.

Felber, P.: Anlage und entwicklung des maxillare und praemaxillare beim menschen, Morphol. Jahrb., 50:451-499, 1919.

Vallois, H. V., and Cadenat, E.: Development de l'os premaxillaire chez l'homme, Compt. rend Soc. de biol., 90:1322-1324 (May 23) 1924.

Wood-Jones, F.: Ancestry of Man, Brisbane: 1925.

Remane, A.: Der verschluss der intermaxillarnaht bei den Anthropoiden, Anthrop. Anz., 4:46-55, 1927.

Wood-Jones, F.: Man's Place Among Mammals, New York: 1929, pp. 316-319.

Augier, M.: Sur le developpement du premaxillaire humain, Compt. rend. l'assoc. anatom. 27 reunion, 1932, pp. 18-28.

THE PULPLESS DECIDUOUS TEETH*

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I HAVE attempted to make a critical review of the different methods of handling devitalized deciduous teeth in the light of my own experience in trying to keep pulpless deciduous teeth in a healthy condition until their permanent successors were ready to erupt.

It is necessary to confine the review of dental literature to the last three years' publications of the *International Journal of Orthodontia and Dentistry for Children,* THE JOURNAL and the *Dental Cosmos.* To these were added the three text-books on dentistry for children by Jordan,[1] Hogeboom[2] and McBride.[3] This review, although incomplete, gives a fairly accurate conception of deciduous root canal therapy as it is practiced in the United States today. Articles commenting on pulpless deciduous teeth were written by eighteen different authors in the previously mentioned reference work. These writers divided themselves into

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1. Jordan, M. Evangeline: Operative Dentistry for Children, New York: Dental Items of Interest Publishing Co., 1925, p. 74.

2. Hogeboom, F. E.: Practical Pedodontia, etc.: St. Louis: C. V. Mosby Co., 1933, p. 151.

3. McBride, W. C.: Juvenile Dentistry, Philadelphia: Lea and Febiger, 1932, p. 49.

three groups. Group 1, consisting of Bray,[4] Evans[5] and Main,[6] advocated extraction of all devitalized deciduous teeth.

Group 2 advocated the saving of deciduous teeth with exposed pulps that are not putrescent, and extraction of all deciduous teeth that have putrescent pulps. This group consists of Easlick,[7] Gardner,[8] Harris[9] and Keys.[10]

Group 3 urges the saving of deciduous teeth with putrescent pulps only after careful diagnosis shows such procedure to be advisable in the light of certain indications and contraindications mentioned later in this paper. In this group are Clayton,[11] Foster,[12] Gurley,[13] Hogeboom,[2] Jordan,[1] Kabnick,[14] McBride,[3] Rich,[15] Sellwood,[16] Stanton[17] and Sweet.[18]

Thus, we find that fifteen out of eighteen dentists who include service for children in their practice advocate saving deciduous teeth with nonputrescent pulps if careful diagnosis indicates a favorable prognosis. This overwhelming majority in favor of saving pulpless deciduous teeth certainly justifies a study of devitalized deciduous teeth, that every dentist who includes children in his practice may exercise the reasonable care, judgment and skill which the law requires of him.

Why should we save devitalized deciduous teeth? Children are given teeth so that they can chew their food. The child is growing fast and needs well-masticated food for maximum growth and development. Every pedodontist can cite cases wherein the mother reports increased weight and better health after her child's masticating efficiency had been increased by replacement of lost deciduous molars with artificial dentures. If this is so, how much better it would be to save the teeth themselves, which are so much more efficient than partial dentures, which are unsatisfactory at the best. Another purpose a deciduous tooth serves is to aid in jaw growth and development by maintaining width as the tooth posterior to it exerts a mesially directed pressure in its course of eruption and growth. This space maintained by the deciduous tooth is necessary for the normal eruption of the succeeding permanent tooth. Every dentist who keeps a deciduous tooth

4. Bray, C. B.: Clinical Aspect of Conduct of Dental Practice for Children, Internat. J. Orthodon., 20:378 (April) 1934.

5. Evans, G. P.: Abscessed Deciduous Tooth, Internat. J. Orthodon., 19:1204 (Dec.) 1933.

6. Main, L. R.: Roentgenogram, a Guide in Children's Dentistry, J.A.D.A., 22:965 (June) 1935.

7. Easlick, K. A.: Operative Procedures in Management of Deciduous Molars, Internat. J. Orthodon., 20:592-593 (June) 1934.

8. Gardner, T. A.: Treatment of Exposed Pulps in Deciduous Teeth and of Abscessed Deciduous Teeth, Internat. J. Orthodon., 21: 876 (Sept.) 1935; Proper Dental Care for Child Patient, J.A.D.A., 17:2320 (Dec.) 1930.

9. Harris, S. D.: Dental Practice for Children, Internat. J. Orthodon., 19:531 (May) 1933.

10. Keys, E. H.: Operative Procedures with Special Reference to Pedodontia, Internat. J. Orthodon., 19:430 (April) 1933.

11. Clayton, J. M.: Dentistry for Children, Internat. J. Orthodon., 20:691 (July) 1934.

12. Foster, H. R.: Practice Dentistry for Children as Preventive Orthodontics, Internat. J. Orthodon., 19:1031 (Oct.) 1933.

13. Gurley, J. E.: Indications, Contraindications and Technic in Treatment of Infected Deciduous Root Canals, J.A.D.A., 23:113 (Jan.) 1936.

14. Kabnick, Stuart: Should Deciduous Teeth with Nonvital Pulps Be Treated? Internat. J. Orthodon., 19:1043-1049 (Oct.) 1933.

15. Rich, Celia: Prophylactic Care of Child's Mouth, J.A.D.A., 22:1598 (Sept.) 1935.

16. Sellwood, R. H.: Method of Root Canal Treatments, Internat. J. Orthodon., 19:753 (July) 1933.

17. Stanton, W. G.: Nonvital Deciduous Tooth, Internat. J. Orthodon., 21:181 (Feb.) 1935.

18. Sweet, C. A.: Treatment and Maintenance of Pulpless Deciduous Teeth, J.A.D.A., 22:1972 (Nov.) 1935.

in a healthy condition is rendering the most valuable of services, that of prevention—prevention of disease and prevention of malocclusion of the teeth. He is helping the child to develop into a normal healthy being.

The devitalized deciduous tooth must not be saved at the expense of bodily health. We must not save a pulpless deciduous tooth that is a focus of infection. It is the purpose of this paper to indicate which teeth should be extracted and which teeth can be saved and maintained in a healthy condition as judged by our present knowledge. The review of the literature disclosed only two reports on the relation of deciduous teeth and the diseases of childhood. Ellis and Luten,[19] in 1935, reported that they were unable to find any connection between untreated abscessed deciduous teeth and systemic disease. This, they believed, may be due to the fact that an abscessed deciduous tooth usually has better drainage than a pulpless permanent tooth. They studied a group of ninety-eight children whose abscessed deciduous teeth had been carefully extracted, brain broth and blood-agar cultures of the apices made and an agglutination test made of the blood. The bacteria were differentiated and cultures injected into animals. The lesions that developed bore no anatomic relationship to disease in the patient from whom they came. A survey of the literature made by Ellis and Luten revealed only one other report on this subject. Smith and Ludwick,[20] in 1919, studied 107 cases of abscessed deciduous teeth giving principal attention to the bacteriology of the apices. They found streptococci in forty-eight cases. Eight cases were reported as sterile. The remainder had staphylococci, *Bacillis pyocyaneus,* pneumococci, Vincent's organisms and diphtheroid bacilli. Smith injected rabbits with all his streptococci strains. Of the forty-eight animals inoculated, five showed multiple abscesses of the kidneys; one, cardiac muscle involvement; one, brain tissue involvement, and four, joint lesions. In each instance, streptococci were recovered in culture from the lesions. No evidence of selective localization was observed. Smith regards this production of eleven infections in the forty-eight animals as evidence of the seriousness of the original dental infection and believes that the abscessed deciduous tooth should be extracted, the malocclusion which might result being of secondary importance.

These two divergent findings are cited not to justify the saving of all pulpless deciduous teeth in one case and the extraction of all devitalized deciduous teeth in the other, but rather to show that these were the only two reports found of actual scientific research on abscessed deciduous teeth. Remember that, in both cases, untreated abscessed deciduous teeth were used. No work was found wherein carefully treated devitalized deciduous teeth were tested. I hope some competent research worker will soon see fit to test our carefully treated devitalized deciduous teeth from both the bacteriologic and the histopathologic aspects.

Only by the clinical method of attack have we been able to compare the effect of a properly treated devitalized deciduous tooth on the host as against the effect of a vital deciduous tooth. In thirteen years of treating carefully selected pulpless deciduous teeth in patients, many of whom have been under the careful supervision of pediatricians, I have had but one case in which there seemed to be a possibility of connection between a

19. Ellis, R. C., and Luten, Miriam: Deciduous Teeth and Diseases of Childhood, J.A.D.A., 22:1117 (July) 1935.

20. Smith, A. L., and Ludwick, R. W.: Bacterial Findings in 107 Cases of Abscessed Teeth in Children, Nebraska M. J., 4:131 (May) 1919.

treated pulpless deciduous tooth and an organic malfunction. Compare the root resorption of a pulpless deciduous tooth with that of its vital mate on the opposite side of the same jaw: The majority of pulpless deciduous teeth are exfoliated at about the same time as the corresponding tooth that is vital on the opposite side of the jaw. Where there has been destruction of alveolar bone from putrescence, the pulpless deciduous tooth is usually exfoliated earlier and the permanent tooth has less resistance to overcome as it erupts. Were disease present in these pulpless deciduous teeth, we would expect it to interfere with the normal root resorption and tooth exfoliation; but this apparently does not happen.

Any imperfection of root canal filling is being corrected as the absorption of the apices of the deciduous teeth takes place; which is not true of pulpless permanent teeth. Another thing to consider is the greater recuperative power that a growing child has as compared with an adult. A child may not be more resistant to diseases than an adult, but there does seem to be some evidence that many diseases are less fatal in childhood than at later times, as explained by Thompson.[21] If infection is present, it is for a limited time only, as in one, two or three years, the devitalized deciduous tooth usually is shed and its successor takes its place. The least important reason from the health standpoint, but the most important from the orthodontic point of view, is the impossibility of constructing retainers as satisfactory as the deciduous tooth itself. Removable retainers are an inconvenience to the patient and dangerous, in that they are small and easily swallowed or inhaled. Fixed retainers usually consist of bands that have to be recemented at least once a year to avoid dental caries where cement has disintegrated and washed out from under the band. Usually, these bands have to be recemented oftener because the ordinary mastication loosens one or more of the bands, which are necessarily narrow when placed on deciduous teeth. At least one of the abutments of a space retainer is a deciduous tooth that normally, or because of the extra burden of the retainer, is exfoliated before the permanent tooth erupts into the space that is being retained. Also construction of a space retainer that occludes with the antagonizing tooth is impracticable and thus the antagonist is permitted to extrude and the efficiency of mastication is decreased.

Another reason that it is advisable to devitalize deciduous teeth if the pulp is exposed is that not one of the eighteen references consulted suggest pulp capping, even though the tooth is uninfected, and eleven of the eighteen deliberately advise against it, reporting only failure where it has been attempted. Hogeboom reports that this is because the deciduous pulp has to resorb the roots of the deciduous dentition, and that it is this resorption process which militates against a successful pulp capping in a deciduous tooth.

Having given the reasons that teeth should be extracted, it is now in order to determine which teeth should be extracted because of unfavorable prognosis and which teeth have a favorable prognosis as regards retention. Clayton, Easlick, Foster, Gurley, Hogeboom, Jordan, McBride, Rich, Stanton and Sweet all emphasize that it is not so much the technic or medicaments that are used, but the teeth that are chosen, that determine the success or failure of deciduous root canal work. If every one attempting the treatment of devitalized deciduous teeth will remember that the most important things to learn are the contraindications,

21. Thompson, C. W.: Are Children More Resistant to Disease Than Adults? Internat. J. Orthodon., 19:1062-1065 (Oct.) 1933.

he will best be able to render the highest type of service to the child patient, that of prevention; in this case, the preventing of malocclusion.

The first contraindication arises when the child is in poor health at the time the work is to be done. All the writers advised against the saving of pulpless deciduous teeth when the patient's health is not up to par, unless it is a transitory condition. Sweet reported a case of heart malfunction and poor general muscle tone that showed rapid improvement after the treatment of two putrescent deciduous molars.

Another contraindication arises when less than one third of one or more roots is present. Although sterility of the tooth can be obtained, it is only a short time before further root resorption establishes an opening into the oral cavity and reinfection follows, necessitating extraction. Roentgenograms are the only reliable means of determining this. Bite wing films usually include all of the posterior teeth, upper and lower, and reveal many otherwise unrecognized conditions, and at a very low cost.

This same roentgenogram also discloses the amount of destruction of alveolar process. If practically all of the alveolar process has been absorbed and the tooth is loose, the prognosis is unfavorable, although only experience will teach how much bone will be replaced after treatment. Do not be confused by the normal absorption of bone that precedes the normal eruption of the permanent tooth. Study this normal bone absorption in roentgenograms of vital deciduous teeth for comparison.

If there is a perforation through the bifurcation of the roots either from caries or absorption, so that there is an opening from the pulp chamber into the alveolar bone between the two roots of a molar, extraction is indicated, treatment of these teeth having always resulted in failure. This perforation can be determined by the use of an explorer and usually shows in the roentgenogram.

If the pus has destroyed the attachment of the peridental membrane, so that pus exudes from the free gingiva, failure will always follow attempts at saving such deciduous teeth because, even though the tooth is sterilized, the peridental membrane does not become reattached and the tooth is reinfected from the bacteria in the oral cavity.

If a fistula remains after the root canals have been sterilized and filled, curettement, to be described later, is indicated. If the fistula remains after curettement, extraction is indicated.

If the canals cannot be so sterilized by treatment as to smell sweet and remain dry, extraction is indicated. Jordan determines sterility by the noneffervescence of hydrogen peroxide placed in the root canals.

Sweet advises extraction of those pulpless deciduous teeth with no permanent successor present. Gurley advises saving these particular teeth. I recognize that these teeth need to be saved if it is at all possible, but in a very limited number of these particular cases, I have had the same result as Sweet. Perhaps this is due to a difference in technic, and under the same particular circumstances, I shall use Gurley's technic. McBride advises extraction of those acutely putrescent deciduous teeth when drainage is not obtainable through the pulp chamber. I have saved many such teeth provided the formocresol was not too old. The bottle of formocresol should be dated at the time of purchase and discarded before a year has passed.

Clayton extracts the tooth when the adjacent tissue is discolored. I believe that this discoloration is probably a symptom of fistula at the free gingiva or an

indication of excessive root or process absorption, all of which were previously mentioned. Both Hogeboom and McBride advise extraction of pulpless deciduous teeth in children who are not tractable. This is a question of child management and not root canal therapy. If a child is tractable enough to prepare cavities in vital teeth, surely he will be tractable enough for root canal therapy in nonvital, nonsensitive teeth. McBride also advises extraction in those patients whose parents are not appreciative of the value of a pulpless deciduous tooth. This is a question of taking the time to educate the parent to the importance of these teeth. This avoids embarrassment later on when the parent berates the dentist for not having explained the value of these teeth as space retainers.

TREATMENT UNDER FAVORABLE PROGNOSIS

1. *Nonputrescent Deciduous Teeth or Those with the Pulp Exposed.*—As previously mentioned no attempt at pulp capping should be made in deciduous teeth as failure always results. Devitalization of exposed pulps is accomplished by pressure anesthesia; infiltration or block anesthesia, or the use of arsenic or of formaldehyde. Easlick devitalized the teeth by cementing polymerized formaldehyde over the exposed area for seven days. Gardner uses procaine pressure anesthesia. Clayton, Foster, Harris, Jordan, Keys, McBride and Sweet all use arsenic for devitalization, the most popular form being a small wafer containing one-fiftieth grain of arsenic with some procaine. This can be cut in halves or quarters, and is dipped in an essential oil, sealed over the exposed area and left in from one to two days by the majority, although Clayton leaves it in from four to seven days. Some use a cement seal, some, guttapercha, but all advise keeping the arsenic away from the gum to prevent the destruction of soft tissue. Jordan reports that pressure anesthesia often produced infection at the root apices. She also reduces the hyperemia of pulps before applying arsenic by using carbolized resin at the first treatment. Clayton gives a twenty-four hour treatment with eugenol to avoid pain from the use of arsenic. It is my experience that the use of the combination wafer containing arsenic and procaine dipped in phenol or eugenol at the time of application insures against pain and obviates the extra appointment.

Clayton, Easlick, Gardner, Harris, Jordan, Keys and McBride all remove the pulp after the use of the arsenic, but Hogeboom and Sweet and I apply a treatment of formocresol that not only sterilizes but also mummifies or toughens the pulp tissue or makes it leathery so that the pulp comes out in a few pieces without hemorrhage. Some remove only the coronal portion of the pulp, and some attempt to remove all the pulp, but all warn against employing the broach beyond the end of the root canal. The absorption of deciduous molar roots takes place first on the side between the roots; which places the end of the root canal anywhere up to 3 or 4 mm. occlusally from the end of the root. Any broaching in this alveolar tissue renders less favorable the prognosis of root canal work. The important thing is not to go beyond the end of the root canal. It apparently makes no difference how much tissue is left in the root canal. Clayton, Easlick, Harris and Jordan remove only the coronal portion with a large bur. This technically may be called a pulpotomy. Hogeboom and McBride remove all the pulp. I remove only that which can be taken out with a fine explorer, using no barbed broaches at all. Thus, there is apparently great variation of technic possible as long as one does not employ the

broach through the end of the canals.

In the next step, Clayton gives one eugenol treatment for four or five days and then fills the root canals. Easlick fills canals immediately after amputation, after one week's desensitizing with polymerized formaldehyde. Hogeboom, Jordan, Keys, McBride, Sweet and I all follow amputation or extirpation with from one to three treatments with formocresol or beechwood creosote, or both, used at different times. Gardner seals in one application of phenol compound for forty-eight hours before filling the root canals. The various root canal filling materials include pastes of aristol, glycerine and iodine, zinc oxide and eugenol, zinc oxide and beechwood creosote, zinc oxide-zeroform, phenol and glycerine, Gysi's paste, thymolized calcium phosphate with formocresol, zinc oxide-bismuth-iodine and any essential oil, alum paste, root canal sealer powder and glyceride of iodine solution and oxapara. Here again, success is obtained with any one of many different materials, but essentially all consist of a paste of some inactive powder, such as zinc oxide, with an essential oil, such as eugenol.

2. *Infected or Putrescent Deciduous Teeth.*—Here, less variation of technic is found. Nearly all writers recommend three treatments of formocresol or beechwood cresote, varying from one to seven days apart, followed by any of the root canal fillings mentioned above in filling nonputrescent root canals. Certain fundamentals must be kept in mind. Ready access to the pulp canals is imperative. All of the top or ceiling of the pulp chamber is removed so that the operator can see into every canal. If swelling is present, certain operators open and drain the canal before starting treatment; others seal in formocresol immediately. It seems to make little difference. All débris or contents of the pulp chamber must be removed or washed out to get the maximum effect from the sterilizing agent. Employing a broach beyond the canal opening is absolutely prohibited, a broach being employed to remove the contents of the canals and only after at least one sterilizing treatment, in order not to force septic material beyond the ends of the root canals. No reaming is necessary, and certain operators use no broaches at all, but only fine pointed explorers, as is my practice. As in the case of the nonputrescent teeth, the root canal filling is worked down into the canals with fine explorers, the chamber filled with the root canal paste and a cotten pellet used as a plunger to force the root canal filling toward the apices. A thick mix of cement is then placed in the pulp chamber and used as a plunger. It is left in as a base on which to make the metallic restoration. Most operators make the restoration immediately, although some wait a few days.

If a fistula persists after treatment and root canal filling, Sweet suggests curettement as follows:

> Keeping the tissues dry the operator applies a topical anesthetic to the surface for one minute. The fistula is touched with 95 per cent phenol and with a large rosehead bur (round bur about No. 6) in the contra angle handpiece, the bur is inserted in the fistula opening and the necrotic tissue is burred in all directions until sound tooth structure or alveolar process is reached. The bur is removed and the area is allowed to bleed through the fistula opening for a few moments. A small piece of gauze saturated with camphor phenol compound is then placed in the opening to allow drainage. This wick is removed by the parent before bedtime and after the oral cavity has been thoroughly cleansed, if healing has not been so rapid that the wick is displaced.

I vary this technic by curetting with a large spoon excavator instead of using the bur. Jordan inserts in the fistula a drain

having iodine on it, leaving it one day, and then changes to a camphor-phenol drain, or phenolsulphonic acid (aseptol) drain, if pus is present. If, after these efforts, the fistula continues, extraction is indicated.

SUMMARY AND CONCLUSIONS

1. The great majority feel it their duty to save pulpless deciduous teeth when the prognosis is favorable.

2. The most important issue is to know which teeth to extract and which teeth can be preserved in a healthy condition as outlined in the first part of the paper.

3. Pulp capping of deciduous teeth is absolutely contraindicated.

4. The majority handle exposed pulps by devitalizing with a weak arsenical preparation followed by one or two sterilizing treatments with formocresol or beechwood creosote. The pulp is either amputated or extirpated, and a paste of zinc oxide and an essential oil such as eugenol placed in the canals and chamber.

5. No broaching must be employed beyond the end of the root canals, which may be occlusally to the root end because of the manner of root resorption.

6. The putrescent deciduous tooth is handled as follows by most operators: three treatments with formocresol or beechwood creosote followed by a root canal filling of zinc oxide and an essential oil.

7. If fistulas are present after treatment and filling of root canals, curettement is indicated; and if the fistula persists, extraction is necessary.

It is the duty of the dental profession to keep the mouths of their child patients free from dental infection by early filling, extraction or careful selection and treatment as indicated in this paper, in order that health may be said to be the goal of the profession.

1904 Franklin Street.

DISCUSSION

Haidee Weeks, New Orleans, La.: Dr. Foster has reviewed the recent literature on the pulpless deciduous teeth from all outstanding pedodontists. All of us agree that we should maintain the deciduous teeth until time for their successors, and many claim great success. I believe that the greatest success we can have is not to have conditions which necessitate devitalization. There were no textbooks when I started to write on children's dentistry, in 1914 and I could count on my fingers the men, outside of orthodontists, who were specializing in dental work for children. In those days, if I had had a patient with a tooth in which the pulp needed extirpation and the root canals needed filling, I really would not have known what to do about it. The teeth were either so badly broken down that they had to be extracted, or were easily treated, and permanent silver amalgam fillings could be inserted. In Dr. Foster's classification in Group 1, the health of the child must be considered first by the writers who advocated the extraction of all pulpless teeth. In Group 2, I heartily agree that teeth with putrescent pulps should be extracted. Our greatest effort should be to save all deciduous teeth until their exfoliation is normally caused by the activity of their successors. But how many of us can say that no harm is being done to the child that carries that tooth? Again, how can we think of saving a pulpless deciduous tooth that is a focus of infection? It is beyond my comprehension how anything *sterile* can be found in the pus of abscessed deciduous teeth, as was stated by Ellis and Luten. I would like to know what sterile pus is. In my opinion, the reason for the earlier eruption of the permanent tooth that follows the putrescent deciduous molar which has been exfoliated earlier is that the irritant which causes the excessive energy of the osteoclasts also causes the same energy of the osteoblasts,

and thus the earlier absorption of the deciduous roots and, simultaneously, the formation of the roots of the permanent successor. This, of course, occurs when there has been destruction of the alveolar bone from putrescence. Why do children have rickets and poorly formed and hypoplastic teeth when they have been given the proper foods, viosterol, cod-liver oil and plenty of sunshine, and their mothers have been given care during pregnancy? I don't know why. Do you?

IMPORTANCE OF ESTHETIC FACTORS IN FULL RESTORATIONS*

By EARL L. RICHEY, M.S.D., D.D.S., Chicago, Ill.

IN order to get an idea of what has been done in esthetics in prosthetic dentistry, it will be necessary to give a brief history of the specialty. Early prosthetics was devoted almost exclusively to the construction of appliances to restore lost teeth for appearance only.

Basing their knowledge on deductions made from the study of specimens found from time to time, scientists tell us that there are indications that prosthetic dentistry was practiced by the Phoenicians and Egyptians as far back as 1500 B.C. or earlier.

From about the beginning of the Christian era, there may be found historical reference to the manufacture of prosthetic appliances, and it is evident that removable artificial sets were made. During the Middle Ages, little progress was made in prosthetic dentistry. The first full dentures seldom contained more than the anterior teeth and were held in position by springs. Efforts were made in 1690 to produce a material that would make a better appearance, and until the time when the S. S. White Dental Manufacturing Company placed their porcelain teeth on the market, about 1845, dentists had considered nothing but esthetic values in making restorations. Therefore, it will be seen that a consideration of esthetics in prosthetic dentistry preceded the art of restoring the function of mastication by more than 3,000 years.

From this history, it would seem that esthetic considerations should be farther advanced than function and efficiency; but this is not the case. In recent years, so much has been done in specialized technics and in perfecting mechanical ability and we have been so much interested in functional requirements that we have almost lost sight of the importance of esthetics. We need only to look about us and see the dentures that are so obviously artifical to convince ourselves that this subject has been much neglected, while dentists have been busy perfecting the details of technical procedures. All this is very necessary. Satisfactory mechanical and functional results must be obtained, but unless we combine the artistic with the scientific in full denture construction, we are not giving our patients professional service.

*Read before the Section on Full Denture Prosthesis at the Seventy-Seventh Annual Session of the American Dental Association, New Orleans, La., Nov. 5, 1935.

A search of the literature shows that little has been written on esthetics that does not present tooth selection as one of the most important factors. Tooth selection constitutes a subject that is too broad and complicated to be discussed here. It is in fact a subject in itself, and one of the most important esthetic considerations in full denture construction.

Esthetics may not mean exactly the same thing to each of us, yet we will all agree that beauty, harmony and natural appearance are the fundamental esthetic requirements. B. L. Hooper,[1] who has done such outstanding work along the line of introducing art into full denture construction, says, "Unless personality and individuality are correlated with the scientific requirements in building full dentures, and unless we develop an appreciation of fine art in prosthodontia, ideal service can never be attained."

Art, as applied to full denture construction, is in itself a science. Artistic ability seems to be natural in some dentists; but by the average dentist, it is attained only by oft-repeated trial. Experience, and a natural desire for the good and beautiful, will aid in creating beautiful, natural appearing denture restorations. It is a known fact that full denture construction is the bugbear of dentistry with the majority of practitioners. They openly admit their dislike

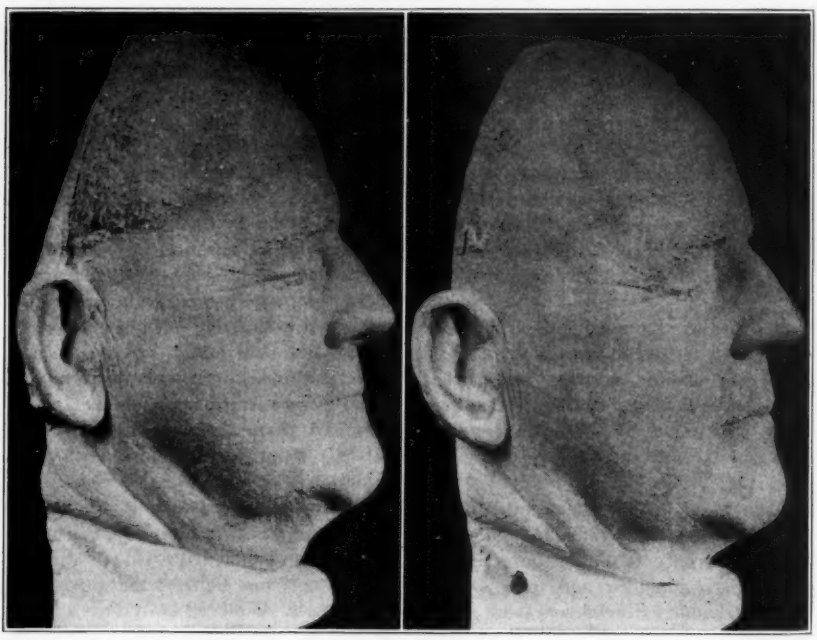

Fig. 1.—Left, facial mask showing profile with old denture in position. Right, facial mask showing improvement in profile with properly constructed dentures in position.

1. Hooper, B. L.: Prosthodontia as Fine Art, D. Digest, 33:691 (Oct.), 774 (Nov.) 1927.

for this type of work, and only do it when compelled to do so. Consequently, as much of the work as possible is delegated to the laboratory, and therefore the denture is mainly constructed by, and the esthetic values left almost entirely in the hands of, some one who has never seen the patient, and whose responsibility ends when he delivers the completed case to the dentist, who, in turn, persuades the patient to accept the dentures, unsatisfactory though he may know them to be. And although they may function creditably, they can never be a source of satisfaction to the wearer, nor cast any credit on the dentist who made them. How can we ease our conscience when we make restorations of this type? The patient has a right to expect more, and, in this day and age, he does expect more.

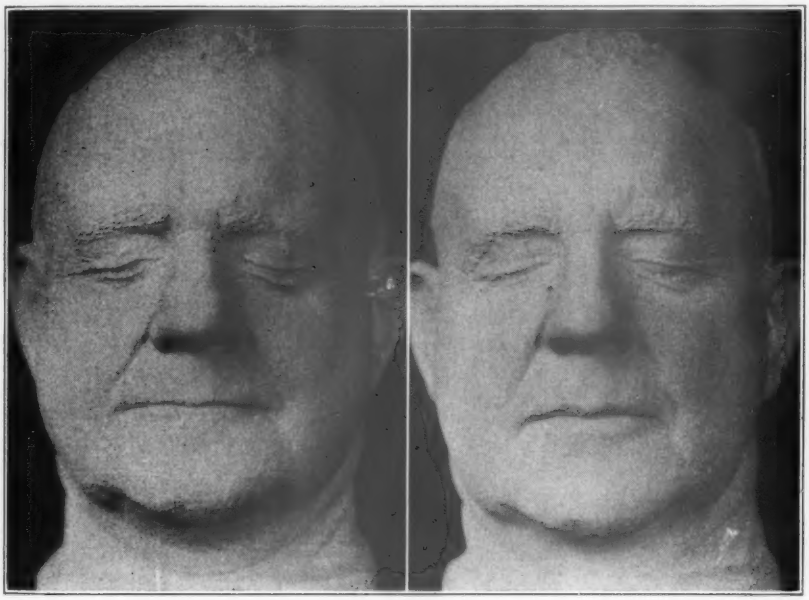

Fig. 2.—Left, facial mask with old dentures in position. Right, facial mask with new dentures in position; showing improvement in lip contour and facial expression.

Formerly, edentulous patients accepted any artificial denture as the best substitute that could be had, and they did not question the appearance. In recent years, the public has become deeply interested in dental conditions. So much is being done in dental education in the public schools, on the radio and in writing. So much is being done in preventive and restorative dentistry that whether we prosthodontists like it or not, we are confronted with the fact that edentulous patients are demanding good-looking, natural-appearing dentures. We must be alert to this need if we are to keep pace with the other branches of dentistry.

Many dentists are missing so much of the joy and satisfaction that comes from rendering a worth while service to the edentulous patient, who may have been

edentulous at a very early age, and often because of mistakes of ours. There is a great difference between so-called "plates" and artificial dentures. To these men I would say, take more time and build personality and individuality into your dentures. Make them something more than just another set of teeth. Know the personal satisfaction that comes, for example, in making for a patient who is only 16 years of age and completely edentulous, who is depressed and actually mentally dull because she feels that she is "different" from other girls of her age, a denture with the greatest esthetic values it is possible to attain, sending her out to face the world fortified with the assurance that she is not handicapped by the absence of teeth. See the change in her mental attitude and appearance, the smile that comes to her lips and the joy that shines in her eyes. You have not only given her the best artificial substitute that is possible, but you have also given back to her the natural happiness and spirit of youth. It is indeed worth while.

When an edentulous patient comes to us, we are compelled to use a certain amount of ingenuity, together with a knowledge of certain rules and principles of esthetics, and a generous supply of good judgment. In other words, we must do the best we can under the existing conditions. A study of the face gives us the necessary data for restoring contour, fullness and length. The esthetic requirements are flexible, and must be determined judiciously. Imagination is one of the keenest possessions of mankind

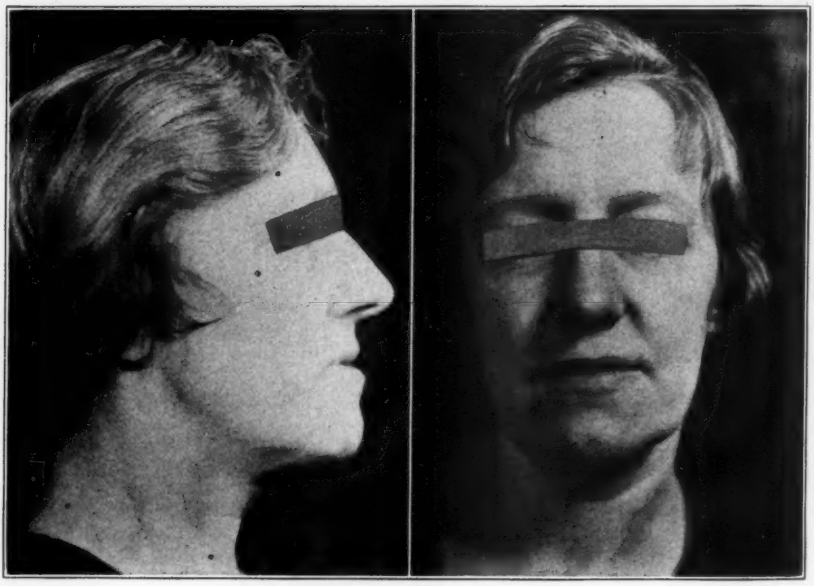

Fig. 3.—Appearance of patient with old dentures in position. The strained facial expression and protrusion of the mandible are the result of an error in centric occlusion. (Compare Figure 4.)

to grapple with problems beyond our immediate comprehension. Yet, like all other sources of good, it can lead into byways and entanglements to which there is no end.

When we assume the responsibility of constructing an artificial restoration, we have two alternatives:

1. If the patient comes to us for consultation before full extraction has taken place, and has a natural, normal, pleasing appearance, we will attempt to duplicate this condition as nearly as possible. In these cases, preextraction records are of utmost importance and material assistance. It is quite simple to duplicate the natural condition. It has been my experience that patients often come after having several sets of unsatisfactory dentures, and it is impossible to secure preextraction records. It seems that the time is rapidly approaching when no complete extractions will be performed without first securing these important records and filing them, as well as full mouth roentgenograms, where they will be available to whoever makes the full restoration.

2. If the natural appearance of the patient is somewhat abnormal, as in a marked orthognathous or prognathous condition, the operator will endeavor to make changes that will assure an improvement over the original condition. This calls for originality and creative ability on the part of the prosthodontist. The delight that accompanies creative work more than compensates for the de-

Fig. 4.—Appearance of patient (Fig. 3) after insertion of new dentures having correct centric relation.

tail and drudgery it entails. We are constantly creating, but the quality of our creations do not always represent our best efforts. In these cases, preextraction records are of no particular value except to show the improvement that has been accomplished by the new restoration. Photographs and facial masks serve admirably for this purpose.

We all realize that, in many cases, it is extremely difficult to attain exactly the result that might be termed "ideal" esthetically, but by properly establishing the following factors, we will be able to build into our dentures a naturalness not to be achieved without such aids.

A thorough understanding of the classification of profiles and their modification is invaluable in this work, and the denture space and centric relation must both be properly established for the most satisfactory results.

When no preextraction records have been obtained, establishing the denture space is entirely the responsibility of the operator, being dependent on his creative and artistic ability. Correct facial dimension and proportion are of the most vital importance to assure a natural, harmonious, symmetrical and pleasing appearance.

Fig. 5.—Appearance of patient with old dentures in position. (Compare Figure 6.)

All through the developmental stage, from calcification to complete development, Nature asserts herself to the utmost to produce a perfect mechanism, and to maintain a proper relation of all component and associated parts. The established vertical dimension in the completed masticatory apparatus maintains all of the associated parts in their proper

relation in accordance with the precision with which they were developed. This vertical dimension does not remain at the height of its perfection for any great length of time. Degenerative changes soon take place and often progress with great rapidity. The wearing of the enamel surfaces of the natural dentition will cause a slight change. The breaking up of the arch through the loss of one or more teeth will cause a shifting and a change in occlusion, with marked change in the vertical dimension of the denture space. After complete extraction, these degenerative changes take place more rapidly, the most visible ones being in the facial proportions and in the size and form of the muscles of expression and mastication. This change in appearance is characteristic of premature old age and waning vitality.

The shortened denture space permits the mandible to go forward and upward, an unnatural prominence of the chin resulting. This also causes a change in ridge relation from the natural development of the anatomic structures. The closure of the denture space causes a distal instead of a vertical pressure to be exerted by the condyle heads. This distal pressure on the anterior surface of the auditory canal causes many patients who are edentulous or who are wearing faulty dentures to experience a loss of hearing, which often is corrected when the denture space has been properly restored and the pressure is exerted in the natural direction. Correct facial dimension is of

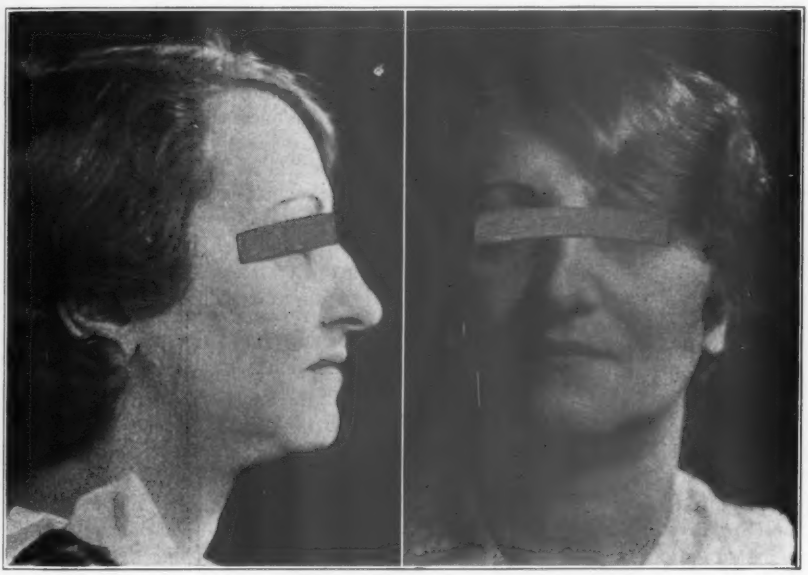

Fig. 6.—Appearance of patient (Fig. 5) with new dentures in position; showing marked improvement in profile and lip contour, which is in harmony with brow line, elimination of deep facial lines, and improvement in chin contour and facial impression.

the most importance to a natural, harmonious and symmetrical proportion.

CENTRIC RELATION

A correct relationship of the mandible to the maxilla is absolutely essential, not only for the proper functioning of the denture and the comfort of the supporting tissues, but also because this proper functioning causes normal contraction and relaxation of the muscles of mastication and permits these muscles to function to the height of their efficiency. Thus, the muscle tone is developed by their exercise, and this, in turn, improves the facial contour. The muscles of expression again become more active through proper positioning of the lips and mandible. This causes a normal development of the face, which becomes fuller, and the worn, aged expression gives way to one expressing a happier mental condition and better health, and a more youthful appearance.

The patient wearing maloccluded dentures that are not in centric relation always presents a strained, unnatural facial expression, which suggests a personality entirely different from the one that the patient in fact possesses. He looks and acts differently to his friends. This changed appearance causes the patient to worry and become oversensitive to his condition. I have never seen a case wherein the mental condition did not become normal and the patient cheerful and interested in life when the denture was so constructed that he was not constantly irritated by it, and when the appearance was pleasing to both him and his friends.

The natural teeth, when in contact (centric occlusion), limit the closure of the mandible, and thus establish the vertical dimension biologically. When artificial dentures are inserted and seated upon the edentulous ridges, their contact governs the denture space, and this space should closely approximate the natural condition, because the masticatory mechanism functions most efficiently in the position that it occupied by nature. Jaws too widely open or too tightly closed are likely to be beyond the range of effective muscular function. The patient with artificial dentures seems to tolerate too tight a closure more readily than too wide an opening. This is explained as follows: Closing the denture space reduces the amount of foreign material in the mouth. It also shortens the line of force from the occlusal surface of the teeth to the crest of the ridge. While this increases the stability of the dentures, it greatly detracts from the appearance. With our present knowledge of dentistry, it is possible to build artificial dentures that not only function efficiently and feel comfortable, but give the patient a pleasing and natural facial expression as well.

CONTOUR OF THE LIPS

The proper contour of the lips is the key to the highest esthetic effect; and unless the lips are given the necessary attention, the expression and character that properly constructed dentures give to the face will be lost. The contour of the lips should be in harmony with the head at the brow line. The natural brow line is nearly always in harmony with the shape of the lips. When the lips are round and shapely, we usually find the natural brow line roundly shaped for harmony. When the lip is long and tapering, with faintly pouting corners, the brow line usually balances them perfectly. An irregular brow line is very often associated with an irregular lip line. When the lips are thin and shapely, the natural brow line is usually thin. With the lip line always in harmony with the natural shape of the

brow, the face is more attractive, youthful and characterful. Thus, a study of nature's plan will help us in shaping the lips of edentulous patients.

A procedure that may be a great help in determining a harmonious contour of the lips is as follows: The patient is seated and the chair is lowered so that the operator stands well above the patient and directly back of the chair. As the operator leans forward, the following contours of the head and face are viewed consecutively: (1) the contour of the head at the hair line; (2) the prominence and contour of the brow line; (3) the fulness and contour of the cheeks laterally through the malar regions; (4) the contour of the lips and (5) the prominence of the chin.

Previously, the mandible has been positioned through its proper centric relation and accepted denture space. This gives the operator four fixed guides in determining the fifth, which is the contour of the lips; and having the contour of the four, it is merely a question of rebuilding or producing a contour of the fifth, the lips, that will be in harmony with and balance the four.

In edentulous patients and patients who are wearing dentures with insufficient vertical dimension, the lips shorten and fall in, deep lines forming from the alae of the nose to the angle of the mouth. There is a marked thickening in the labiolingual aspect of the lips. As time elapses, there is a gradual increase in the number and depth of the short lines running the vertical length of the lips, resulting in a marked change in the size and shape of the orifice of the mouth. First, the amount of vermilion that normally shows in the lips decreases. The cupid's bow is finally eliminated, and the orifice of the mouth becomes merely a transverse slit in the skin of the face.

The successful prosthetist must make an extensive study of the lips and be able to classify them. A clear understanding of the muscles of expression and the function and action of each enables him to set up the teeth and to so contour the restoration that the normal muscle action will be restored. This, in turn, assures normal muscle tone and natural pliability. Labiolingually, the anterior teeth must have the correct inclination to so position the lips that the vermilion shows as it did with the natural dentition. It is possible to restore this condition to perfection as long as the patient does not laugh or smile. Trouble often develops with movement of the lips. If the incisal edge is positioned far to the labial aspect, or the gingival edge is depressed to any great extent, there is a decided tendency for the lip to slide up on this sloping labial surface as the muscles contract. This condition is very apparent in a Class 3 ridge relation when the operator insists on a normal articulation, obtaining this by increasing the labial inclination of the maxillary teeth. As the lip raises, the teeth become more and more visible, and when the patient laughs heartily and raises the lip to the extreme, the teeth in their entirety are exposed to view, and often much of the labial flange of the denture is exposed.

In arranging the teeth on the articulator, and when making the final adjustments, the successful prosthodontist will always have in mind the type of face which the patient possesses, and will always arrange the teeth so that the arch form is in harmony with the face form. This is a rule that should be closely followed in every case. The necessity for this can be readily seen. As the sculptor transfers his ideas to clay, so should the prosthetist transfer his ideas as to the desired facial contour to the model denture. The artificial dentures serve as a frame-

work for the lips and cheeks. The shape and contour of the denture, then, have a definite effect on the cheeks and lips, and are a major factor in molding them to the desired form for the facial restoration.

When placing the finished dentures in the mouth, especially if the case is one which has necessitated much rebuilding, it is advisable to leave the labial flanges quite full in order to give what seems to be an undue prominence to the lips. This condition is explained to the patient, and he is told that it is advisable for him to wear the dentures with this slight fulness for several days, after which time it can be easily and quickly removed if desirable. This extreme tension of the lips has a decidedly beneficial effect on the muscles of expression. The forward tension on the lips stretches the muscles and decreases the lines from the alae of the nose to the angle of the mouth, and eliminates the vertical lines.

By employing all of the aids and artifices that can be used to promote esthetic considerations, the prosthodontist will produce a result that, while not perfect in all cases, will be a great improvement over that obtained with the majority of artificial dentures, and will, in many instances, assure a denture that will virtually defy detection.

Until we have more teachers in the dental schools who have some artistic ability and an appreciation of the finer things in life, and who are competent to produce dentures that show individuality and do not resemble an object of mass production, we can expect very little improvement in the esthetic values of artificial restorations.

DENTAL HYPOPLASIA: ITS OCCURRENCE, HISTOPATHOLOGY AND ETIOLOGY

By JOHN ALBERT MARSHALL, D.D.S., Ph.D., San Francisco, Calif.

IN the engineering science, one of the most important details is the knowledge of the strength of materials. The stresses and strains which a building must bear are computed and the materials which will be strong enough to withstand these forces are selected for the building. The dentist too is interested in the strength of materials, not only in an academic way, but also from the clinical standpoint. The success or failure of a bridge or filling depends directly on the strength, or lack of it, in the underlying dental tissues. All of the tissues are involved: enamel, dentin, cementum, pulp, peridental membrane and bone. It is necessary, therefore, that the forces tending to weaken the resistance of dental structures to disease or wear be studied and, if possible, controlled.

The term "hypoplasia" is derived from the Greek roots meaning "under" and "formation"; i.e., "under" or "deficient" formation. It is not to be mistaken for agenesis, or lack of formation. The term "enamel agenesis" is applied to that condition in which the crown of the tooth erupts without enamel. It consists of exposed dentin. It seldom occurs in permanent teeth and I have seen only three instances in erupted deciduous teeth, which lacked the slightest vestige

of enamel. "Dentin agenesis" without the absence of the entire tooth is unknown as far as I am aware. "Hypoplasia" is distinguished also from "resorption" by the fact that resorption implies the removal by one means or another of previously formed material or tissue. Both dental and medical literature contain confusing references to resorption and absorption. Many authors have regarded them as synonymous terms, but this misconception has of late been corrected and the separate meanings have been clarified.

The differential diagnosis of hypoplasia is based upon the recognition of

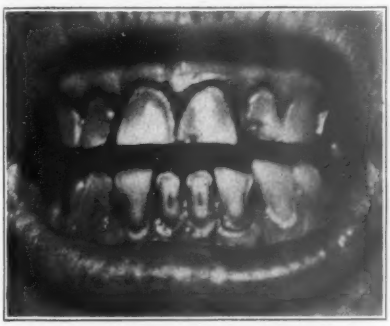

Fig. 1.—Abrasion from using kitchen scouring powder as dentifrice for thirty years.

the following easily confused lesions or conditions: dental caries, abrasion, erosion, attrition, resorption and agenesis. Of these, only caries is characterized by decalcification and progressive molecular disintegration. Abrasion is the wearing away of tooth structure by the action of a foreign body, such as a clasp, or by biting thread, as in the seamstress' bite, or by the presence of the worn facets of the pipe-smoker's bite; etc. Erosion is the loss of tooth structure on the axial surfaces by means other than abrasion and without evidence of decalcification. Attrition is the wear of tooth against tooth and, in some respects, is the normal change due to age. Agenesis, as mentioned above, is lack or absence of formation as is indicated by the derivation of the word, "I generate or produce," with the prefix "a" meaning a lack of production. On the other hand, the term "hypoplasia" refers to deficiencies in size, form and structure, but not deficiencies in number. For that condition, the term "agenesis" is more applicable.

It was pointed out in 1912 by Walkhoff[1] that there is hardly a tooth of civilized man which does not present areas of incomplete formation. Nor is civilized man different from his earlier progeni-

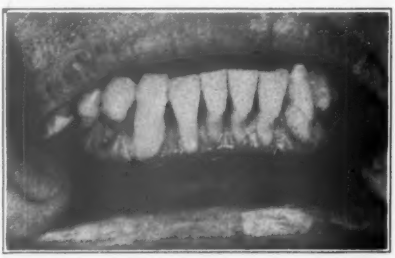

Fig. 2.—Erosion and caries.

tors; for the teeth of Neolithic man likewise showed structural defects. Ten years later, J. Howard Mummery[2] confirmed these observations. Furthermore, similar reports on the teeth of lower animals were published by J. Leon Williams,[3] in 1897. The significance of these findings is only now, and gradually, becoming apparent. When a "defect," so-called, is so wide spread and so

1. Walkhoff, O.: Die Erdsalze in ihrer Bedeutung für die Zahncaries, Berlin: Hermann Meusser, 1915.

2. Mummery J. H.: Structure of Teeth in Relation to Dental Disease, London: 1923.

3. Williams, J. L.: D. Cosmos, 49:55 (Jan.) 1897.

nearly universally observed, it ceases to be a defect at all; rather, it becomes a histologic characteristic of that particular tissue. It is quite obvious that a reaction, or a substance, or a tissue, is abnormal only when it is different from the majority of reactions, substances or tissues. So, in this case, if hypoplasia or defective formation is found in nearly all teeth, it ceases to have any prominence as a curiosity; it is too common, and, if common,

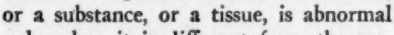

Fig. 3.—Teeth of Piute Indian girl, aged 12, from Nevada. (Mottled enamel.)

Fig. 4.—Hypoplasia.

it must be regarded as a normal structural attribute.

Clinically, it has been observed that areas of enamel or dentin hypoplasia which are visible to the naked eye are not necessarily factors in the pathogenesis of dental caries; but, from the laboratory standpoint, attempts are being made repeatedly to trace a relationship between defective structure and decay. Although the inference often is made that such a connection exists, the clinical observations, admittedly not made with the same meticulous care as that necessary in the laboratory, do not confirm this supposition. But even the laboratory is at a loss to explain why "caries-susceptible areas" do not always correspond in position to hypoplastic tissue. It is perhaps axiomatic that the most common location of caries is in pit and fissure cavities. These coincide quite exactly with faults in formation. Gingival cavities, likewise, develop at a place where apposition of cementum and enamel is defective, or indeed, entirely lacking.

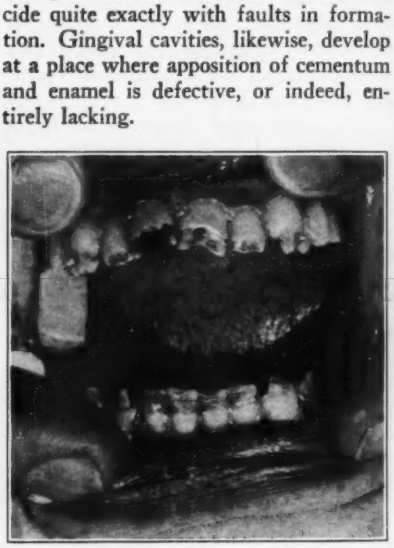

Fig. 5.—Teeth of girl, aged 19, who had measles at 2 years and chickenpox at 12, with scarlet fever in interim. (Hypoplasia and caries.)

It has been stated and restated many times that the most important predisposing factor in the pathogenesis of caries is hypoplasia. When hypoplasia is regarded as defective structure, usually microscopic rather than gross, the lack of sufficient clinical confirmation of this theory is readily explained and understood. It is at least inconvenient, if not quite impracticable, to examine with microscopic exactitude the axial and gingival walls

and margins of a prepared cavity. But a failure in the filling may easily be due directly to the presence of hypoplastic areas in enamel so situated as to escape the scrutiny of the unaided eye. Indeed, it was probable that, with this thought in mind, G. V. Black emphasized the necessity for placing cavity margins in self-cleansing areas, where they could be more carefully studied and prepared. The strength or weakness of dental tissues is no longer a problem for the research laboratory, but becomes of obvious importance in both operative and prosthetic procedures.

Perhaps the two most conspicuous clinical examples of defective formation

Fig. 6.—Partial enamel egenesis.

familiar to many is the dental hypoplasia characteristic of congenital syphilis, and that which is a manifestation of infant rickets. Furthermore, the malformation observed in the permanent teeth of patients who suffered severely in early childhood from any of the exanthems such as measles, chickenpox and scarlet fever, is equally well known. The early loss of the first permanent molars, a frequent clinical observation, may be due indirectly to hypoplasia resulting from metabolic or infectious disease in infancy or early childhood. It is well established that a relationship exists between certain childhood ailments and the development of deficiently calcified tooth structure. In fact, the hypoplasia is not confined to the faulty deposition of the lime salts: it affects the organic matrix as well. In a person "susceptible to caries" (whatever that may mean), the infection in such teeth spreads so rapidly that dental advice is sought too late and the damage is done before operative procedures can be applied. The teeth which generally are least affected by hypoplasia are the deciduous teeth, then the permanent bicuspids, cuspids and second molars. All the other teeth usually present some evidence

Fig. 7.—Case shown in Figure 6.

macroscopically or microscopically of defective formation. This is especially true of third molars, and accounts for the rapidity with which these teeth, when erupted, become carious. The so-called "odontoclasia" of Jones, Pritchard and Larsen is not caries or rampant caries, as far as the published evidence is concerned, but is an exaggerated form of hypoplasia.

Often the question arises: "How can the fact that every instance of exanthematous disease in childhood does not give rise to gross lesions of dental hypoplasia

be explained?" The answer is to be found in the study of calcification. Quoting from an earlier paper:

All growth is characterized by active and inactive periods. During the inactive or latent period the growth processes are slower, and the formation of new tissue thereby retarded. In the event of illness during this time, there is less reason to suppose that defective dental development would arise than would be the case if the illness occured during an active growth cycle. The rate of accretion is slower during the latent period, and a greater interval of time elapses for the formation of organic matrix. During this period, the

Fig. 8.—Case shown in Figure 6.

patient may have recovered. Since the amount of new tissue formed during the illness was small, the degree of malformation will be correspondingly small. It has not been definitely established that maternal malnutrition produces dental hypoplasia in the fetus; but, from the clinical aspect it is evident that this condition is less apparent in the deciduous teeth which are formed before birth. This indicates that the prenatal dental development is probably less subject to variations in nutrition than that of the extrauterine period. Even though fetal growth is more rapid, the rate of dental development is probably greater, and the integrity of the dental structures more uniform. As an example of the differences in rate of growth, the following may be cited: a nine weeks' fetus measured about six centimeters in length; another specimen of seven and one-half months, thirty centimeters. If it is assumed that this fairly represents the rate of intra-uterine growth, it amounts to five hundred per cent. Similar comparisions of the new born infant indicate that the average length is fifty centimeters. Although the average height of man has been variously estimated, it may be postulated at five feet nine inches, (175.5 centimeters). Comparing this with the length at birth, it represents an increase only of 350 per cent as against the intra-uterine 500, and is accomplished in years

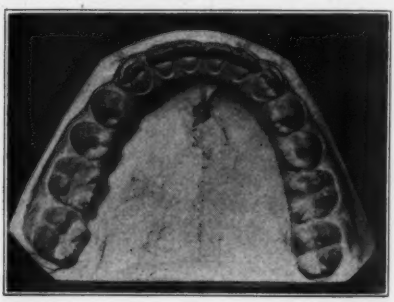

Fig. 9.—Case shown in Figure 6.

instead of months. All growth phenomena occur as a part of a series of active and inactive stages of biological force. Robertson constructed a number of growth curves based upon data collected by the British Anthropometric Committees. These curves in man correspond roughly to those representing the growth of laboratory animals and can be divided into three growth cycles. The first is from birth to about eighteen months, then a slight lag occurs, following which the first cycle continues to about four and one-half years. This is the period of most active extra uterine growth. The second is variously estimated, but appears to be from about ten to seventeen years. There may be several retardations

during this cycle. The third period extends from seventeen to twenty-five years and also is not definitely set. Thus it is evident that there are latent periods of cellular activity during which the rate of skeletal growth is reduced. This probably is true also of dental development, although it is difficult to prove. It becomes of especial interest therefore, to study from the laboratory standpoint the processes by which the normal growth activity of the ameloblast and odontoblast is changed to a pathological function. This study may be pursued conveniently by observing what effects, if any, may result from feeding experiments in which one or more dietary factors are reduced in quantity or excluded. In fact, there is accumulating each year from various parts of the world additional information dealing with the normal and abnormal formation of teeth.

March 20, 1923, at a meeting of the Los Angeles County Dental Society, the first histopathologic findings in the teeth of dogs that had been on deficient diets were presented; an historical fact which has been overlooked by certain foreign experimenters. These reports were further elaborated at the meeting of the American Medical Association in June, 1923, at San Francisco, and again at the meeting of the American Dental Association at Cleveland in September, 1923. Since then, these studies have been greatly elaborated in many institutions.

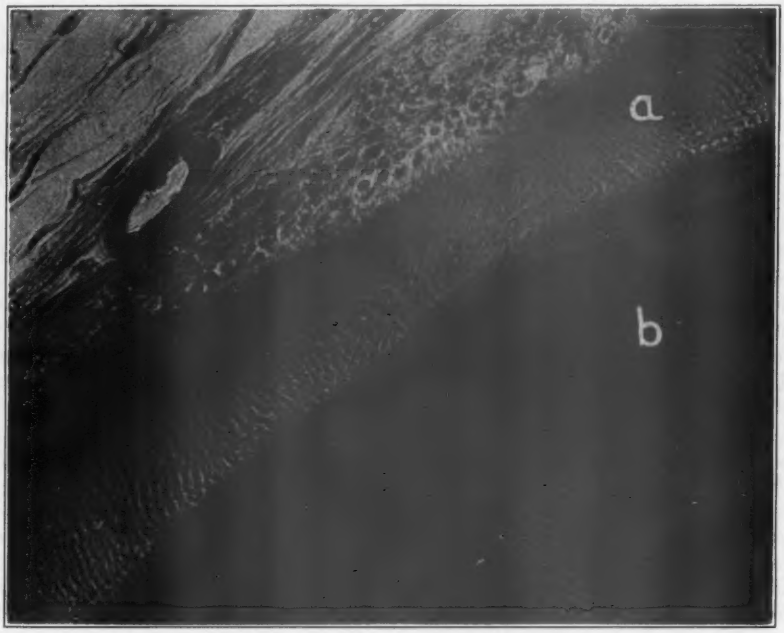

Fig. 10.—*a*, hypoplastic enamel matrix; *b*, hypoplastic dentin matrix.

It has been pointed out in earlier papers on this subject that dietary deficiencies of sufficient severity and duration, when imposed on laboratory animals, cause definite changes in both hard and

soft dental tissues, which are thus summarized: (*a*) The deposition of pulp nodules either in the substance of the pulp or on the walls of the pulp chamber. (*b*) In rats on deficient diets and older than 250 days (corresponding in the span of life to a human being of approximately 20 years), a severe hyperemia in the pulps of the incisor teeth, and to a less degree, in the molar teeth; the odontoblastic layer in the gingival portion, furthermore, undergoing degenerative changes which result in the formation of hypoplastic dentin matrix similar to that formed in the teeth of dogs on deficient diets.

When the dental papilla of the unerupted permanent teeth in a so-called "normal" dog is examined, several outstanding characteristics will be found. First, the odontoblastic layer is fully formed and apparently actively functioning, and is supplied by a rich capillary network. The zone of predentin is narrow and fairly symmetrical in its contour. The young fibers in the predentin are evenly distributed throughout and are of normal size, shape and direction. Likewise, the enamel matrix shows a definite regularity in extent of formation. In rachitic dogs, both deciduous and permanent teeth show definite changes. The radicular dentin of the deciduous teeth and the coronal dentin of the permanent teeth lack various structural elements found in the normal animal. For example, the narrow zone of predentin has widened until it encroaches closely on the dentino-enamel junction. The uncoalesced globules are unevenly distributed in this greatly enlarged zone of predentin. The predentin fibrils are found to be irregularly placed throughout the area. They have lost uniformity in position, direction and distribution. The odontoblastic layer has likewise undergone degenerative changes. Thus, one of the effects of malnutrition is dental hypoplasia.

The experiments of Mrs. May Mellanby on dogs indicate that a deficiency of vitamin A is responsible for the development of dental abnormalities and overgrowth of the gum tissue. If there is a deficiency of vitamin D, there follows the formation of defective alveolar bone, especially if the deficiency occurs early in life. To put it another way: If the diet is defective in vitamins A and D during the active growth period, later in life there will be a predisposition to lesions of the paradentium, even though a wholly adequate diet is followed at maturity. Mrs. Mellanby believes also that caries and paradental disease do not occur simultaneously because of the differences in the vitamin content of the diet. Not all animals respond to the same extent to vitamin A deficiencies, but, as far as is known, all, including man, are affected to some degree.

In addition to these reports, a dietary deficiency of vitamin C and B (old terminology) and D also has been described as a factor in the development of dental hypoplasia. It is probable that this deficiency is only a part of the complex etiology. Certainly it has been shown that normal formation of tooth structure, as well as of bone, is governed by the following circumstances: First, a dietary intake which is adequate in all respects, and especially in the amounts and proportions of available calcium and phosphorus compounds and vitamins. Secondly, the utilization by the tissues of these various substances. This is the more complex of the two, for there are many conditions influencing it, such as the p_H values of blood plasma and the intestinal contents; the amount in blood plasma of ionized and nonionized calcium, of dialyzable and nondialyzable substances and of phosphate compounds,

and the amount of parathormone; as well as the degree of activity of the thyroid gland and its influence on basal metabolism. At present, there is insufficient evidence to justify definite statements as to the degree of importance of these different items. Although they control the local activity in calcifying areas to a large extent, there are, in addition, certain cellular elements to be studied, such as the osteoblast and the catalytic agent of calcification, "phosphatase." It has been demonstrated by Kay and his co-workers, as well as by Bodansky, that, during the formation of bone and tooth structure, there is present in the area a substance which accelerates the deposition of the inorganic salts. The complicated reactions by which this result is accomplished have been described elsewhere, but it is established that the precipitation of tricalcium phosphate is governed by the enzyme "phosphatase." Recently, Jacobson[4] has demonstrated a new specific phosphatase which utilizes blood corpuscles as a substrate. In addition, it presents definite chemical differences from the phosphatase of tissue. In fact, the theory serves not only as a possible explanation for normal tooth development, but it applies also to the mechanism of malformation of dental structures. Furthermore, the resorption of deciduous roots from growth stimulus, or even of permanent roots from injury, may be due to the reverse action of this substance. It becomes, then, quite logical to assume that irritation or injury, by producing a localized hyperemia, brings the enzyme into the area. The acidotic reactions characteristic of injured tissue may tend to activate the phosphatase in the opposite direction, so that instead of building tissue, it tears it down by resorption.

4. Jacobson: Bibliot. f. Laeger, Copenhagen, April, 1933, p. 162.

Recent studies on rickets provide further light on this subject. Smith and Maizels have demonstrated that, in rickets, phosphatase is present in amounts over three times that found in normal growing bone, and they suggest that it is derived from the greatly proliferated cartilage cells and osteoblasts. Robinson has shown that as osteoblasts are one source of the enzyme, its presence in increased quantity is a necessary factor in ossification. This theory of phosphatase action may also be applied in part to the formation of mottled enamel as well as to other types of dental hypoplasia.

Black, McKay, Smith, DeEds and others have made important contributions to the study of mottled enamel. It has been demonstrated by several laboratories that mottled enamel is associated with the presence of fluorides in drinking water as well as in food. Furthermore, it has been stated that fluorides may, in certain concentrations, exert an effect on phosphatase by increasing its activity. If this is the case, there are two suppositions possible: First, the activity of the phosphatase is in the reverse direction, thereby producing resorption. Secondly, the accelerated activity of the enzyme brings about the rapid formation of insufficiently calcified or hypoplastic areas. DeEds has noted that fluorides, instead of increasing phosphatase activity, as is claimed by some investigators, exert an opposite effect and reduce the potency. In either event, there seems to be no reasonable doubt that this substance affects both the formation and the resorption of normal calcified tissue.

SUMMARY

Hypoplasia of dental structures, particularly of enamel and dentin, occurs so frequently that this condition can hardly be regarded as abnormal. Prenatal dental development is less subject than post-

natal to variations in nutrition. Dietary experiments have shown conclusively that hypoplasia may be produced when animals are maintained on diets deficient in any one of several nutritive elements. Likewise, diets containing substances of a toxic nature, such as fluorides, produce changes in tooth and bone substance. The local action is such that the calcifying enzyme "phosphatase" fails to effect the normal precipitation of calcium phosphate.

CANKER SORES (APHTHOUS STOMATITIS): PRELIMINARY REPORT

By JAMES D. GRACE, D.D.S., Ann Arbor, Mich.

EVERY dental practitioner is familiar with the type of oral lesion usually described as a canker sore. It is also well known that the conventional treatment has been eradication by cautery.

About three months ago, I investigated the possibility of successfully employing phosphate therapy in these cases, the vehicle of choice being bone phosphate, friable tablets of 15 grains (consisting of approximately equal parts of dicalcium phosphate and purified bone phosphate). In about twenty cases, the results have been sufficiently encouraging to warrant reporting to the profession. In two cases in which this treatment was used, it was reported that cold sores (herpes simplex labialis) also involuted. As to the latter, I have no comment to make. I am reporting here two case histories.

REPORT OF CASES

CASE 1.—A man, aged 48, a hospital porter, in good health, had suffered from cankers periodically for several years. He stated that his wife, aged 53, and son, aged 23, also suffered from them. He also stated that to obtain relief, he had always resorted to cautery, because, without treatment, the lesions had a duration of about two weeks. This man, as well as his wife and son, employed phosphate therapy, 15 grains, twice a day, with the result that involution of the lesions occurred within approximately forty-eight hours.

CASE 2.—A woman, aged 35, a housewife, in good health, gave a history of canker sores occurring practically every month, with the onset approximately one week prior to the menses and persisting usually for two weeks. As in Case 1, involution occurred about forty-eight hours after the beginning of phosphate therapy. This patient cooperated as follows: In the second month, when she was aware of the formation of the cankers, she started treatment with the result that the lesions aborted. In the following month, the lesions were permitted to form and then therapy was inaugurated, with the complete involution of lesions in about two days.

SUMMARY

Approximately twenty cases of canker sores were treated by bone phosphate therapy, 15 grains, twice a day, each case resulting in involution of the lesions, and, in one control case, producing abortion of the lesions.

625 East Liberty Street.

BACTERIOLOGIC STUDIES OF CARIOUS DENTIN*

By C. P. CANBY, D.D.S., and J. L. BERNIER, M.S., D.D.S., Washington, D. C.

IN more recent years, bacteriologic studies on dental caries have been overshadowed by those dealing more directly with the question of nutrition, as the cause of or a contributing factor in the disease. These attacks on the problem, while important, have furnished, in many instances, only hypothetical explanations of the carious processes.

When the clinical phases[1] of the question are considered, along with the histologic structure of the tooth, these investigations lead us to believe that the time-honored chemicoparasitic theory of W. D. Miller, elaborated on by G. V. Black and J. Leon Williams, must still prevail in the minds of many. Regardless of individual opinion, it is a more or less recognized fact that an adequate well-balanced diet is one of the important factors in the control of the disease.

From a review of literature, and our own observations, clinical, as well as investigative, we believe that there exists a close relationship between dietary, environmental and bacteriologic factors; and that a satisfactory answer will be forthcoming only after exhaustive study of each phase as a unit but also as a contributing factor. How any one or any combination of these factors may affect a predisposition to dental caries, we may only surmise. Regardless of these facts, the ease by which carious-like lesions can be produced *in vitro* by certain aciduric organisms, or *in vivo* as demonstrated by Bunting,[2] emphasizes, in our minds, the importance of oral hygiene. Certain of the nutritional workers have been prone to relegate oral hygiene to the background, disregarding the important consideration of oral environment. Certainly, this attitude is contrary to the belief of the profession, and, if advocated, can only lead to the wholesale appearance of caries and paradontal lesions.

The findings of more recent workers, Boyd, Zentmire and Drain,[3] Tucker,[4] Johnston, Kaake and Agnew[5] and others, that the prevalence of *Lactobacillus acidophilus* has a doubtful relationship to the incidence of dental caries have prompted this investigation. We have attempted to isolate and study the bacteria present in carious dentin, paying particular attention to the prevailing organisms isolated from the deeper layers. All the

*From the Dental Bacteriological Department, Army Dental School, Medical Department Professional Service Schools, Army Medical Center, and the Walter Reed General Hospital.

1. Black, G. V.: Operative Dentistry, Ed. 5, Chicago: Medico-Dental Publishing Co., 1922, p. 65-115. Enright, J. J.; Friesell, H. E., and Trescher, M. O.: J. D. Res., 12:759 (Oct.) 1932. Rodriguez, F. E.: Mil. D. J., 5:199 (Dec.) 1922.

2. Bunting, R. W.; Nickerson, G., and Hard, Dorothy G.: D. Cosmos, 68:931 (Oct.) 1926.

3. Boyd, J. D.; Zentmire, Zelma, and Drain, C. L.: J. D. Res., 13:443 (Dec.) 1933.

4. Tucker, W. H.: J. Infect. Dis., 51:444 (Nov.-Dec.) 1932.

5. Johnston, M. M.; Kaake, Mildred J., and Agnew, Mary C.: Relationship of Lactobacillus to Dental Caries in Experimental Animals and in Human Beings, J.A.D.A., 20:1717 (Oct.) 1933.

specimens were secured by one of us (J. L. B.) from enlisted men on duty at Walter Reed General Hospital, Washington, D. C. These men receive a well-balanced diet, the soldiers' mess being under the direct supervision of the Department of Dietetics.

PROCEDURE

Selection of Teeth.—A careful study of the clinical picture of the tooth to be cultured was made. Roentgenograms were taken when deemed necessary. Only those teeth that we considered vital and suitable for restoration were used. Those teeth in which carious dentin had involved the pulp were not cultured. It was also necessary that the carious lesions be of sufficient size to insure enough material for the inoculum. The presence of a restoration was not considered important enough to exclude the use of an otherwise favorable tooth.

Technic of Operation.—(*a*) Each tooth selected for culture was isolated by means of a rubber dam, and the field of operation was painted with 7 per cent iodine, followed by 70 per cent alcohol. (*b*) The tooth was opened with sterile instruments, and the soft spongy débris, usually present in a cavity of any size, was carefully removed and discarded. (*c*) A pledget of sterile cotton, slightly moistened with 95 per cent phenol, was carefully applied to the exposed surfaces of the cavity. This was followed, in like manner, with alcohol. (*d*) The superficial decay was removed with a second spoon excavator, and placed in a sterile test tube containing 2 c.c. of gelatin-Locke solution and sand. (*e*) The surface of the deeper decayed area was again treated with phenol and alcohol, and, with a third spoon excavator, a specimen was taken as before. (*f*) The specimens were then sent to the dental bacteriologic laboratory for culturing.

In securing these specimens, the material was carefully noted and recorded as to density, color and type of decay (dry or moist).

Medium.—In order to meet the objection raised by Bibby[6] and others, that the initial employment of an acid broth, which is favorable for the growth of *Lactobacillus acidophilus,* may crowd out other important etiologic aciduric organisms present, throughout the experiment we used veal infusion-brain broth, adjusted to p_H 7.2, and containing 0.2 per cent glucose and a small piece of marble. The medium was boiled, and cooled just prior to inoculation. Before inoculation, the gelatin-Locke tubes were thoroughly agitated, and about 1 c.c. of inoculum was used. In addition, particles of carious material were also removed by means of a sterile platinum loop and placed in each culture. The cultures were then incubated at 37 C., and a Gram stain was made as soon as growth occurred. All negative cultures were incubated at least ten days before being discarded. The presence of bacilli in the cultures, characteristic of *L. acidophilus,* were seldom detectible before 48 to 72 hours. As a result, plate cultures from the tubes showing growth were not made until after forty-eight hours' incubation. Material from these positive broths was inoculated on blood-agar, serum-agar, and glucose-serum-agar plates, all adjusted to within a p_H range of from 7.2 to 7.4. Pure cultures for further study were obtained from these plates, and the various organisms were identified by the methods employed in the General Bacteriological Laboratory of the Army Medical School. An acid broth was used for isolating *L. acidophilus* in only a few instances, i. e., when we were unable to recover the or-

6. Bibby, B. G.: Some Neglected Factors in Study of Dental Caries, J.A.D.A., 22:222 (Feb.) 1935.

ganisms from the agar plates mentioned above, or at subsequent platings. In these particular cases, the inoculum was taken from the glucose-brain broth cultures.

The inoculation and incubation of glucose-brain broth tubes, both aerobically and anaerobically, was done in only a few instances. To isolate the various organisms present in the mixed cultures, we often found it necessary to incubate the plate cultures anaerobically.

brown, giving the typical appearance of arrested caries.

The bacteriologic findings for those cases in which both superficial and deep dentin cultures were obtained are recorded in the accompanying table.

Under A is recorded the incidence of growth in glucose-brain broth. The presence or absence of micro-organisms was determined by recording turbidity, by studying microscopically Gram's stain

BACTERIOLOGIC FINDINGS

No. of Teeth Cultured		Glucose-Brain Broth Cultures						
		A			B			
					Incidence of L. Acidophilus in Positive Broths			
		No. Positive	No. Negative	Per Cent Negative	In Mixed Culture	In Pure Culture	Absent	Per Cent Positive
36	Superficial carious dentin	33	3	8.3	23	8	2	93.9
	Deep carious dentin	23	13	36.5	3	18	2	91.3

BACTERIOLOGIC FINDINGS

A total of forty-four carious teeth were examined. In eight of these cases, the carious material was too meager to permit of more than one specimen. From the remaining thirty-six teeth, culture material was obtained from both the superficial and the deep dentin layers.

The eight teeth from which only one specimen was obtained were negative on culture. The carious material from each of these cases was hard, dry and dark

preparations, and, in questionable cases, by inoculating suitable agar plates and incubating under aerobic and anaerobic conditions. Three of the thirty-six specimens from cultures of superficial as well as of deep portions were negative. Thirteen from the deep carious material were negative.

Under B is recorded the incidence of *Lactobacillus acidophilus* in the positive broth cultures. *L. acidophilus* was isolated in thirty-one instances (93.9 per

cent), eight times in pure culture, from the superficial carious material; and in twenty-one instances (91.3 per cent), eighteen times in pure culture, from the deep carious dentin.

The organisms isolated from the mixed cultures, containing *L. acidophilus,* were those normally present in the saliva. They were, in order of frequency, other than *L. acidophilus, Streptococcus viridans, Neisseria catarrhalis,* or closely allied species, *Micrococcus gazogenes, Staphylococcus albus* and, occasionally, gram-positive aerobic spore-bearing bacilli.

In the four positive cultures from which *L. acidophilus* was not recovered, *Streptococcus viridans* were present in both superficial specimens; once, in pure culture, although the corresponding deep specimen was negative; and, in the other instance, in association with the spore mentioned above. In the deep specimens, *Streptococcus viridans* was present alone in one culture; while, in the other, only a gram-positive spore-bearing bacillus was isolated.

COMMENT

In securing specimens for bacteriologic examination, we attempted to obtain material free of gross contamination in order to make a more accurate determination of the prevailing flora of carious dentin. The technic described in obtaining the specimens we do not believe had any significant bearing on the findings relative to the organisms actually present within the decayed mass. While eleven cultures were negative, eight from cases in which only one specimen was obtained and three from which two specimens, a superficial and a deep, were obtained, with the exception of one instance these carious lesions could be definitely classed as an arrested type. This is likewise true of the two positive cultures obtained from superficial dentin, and the deep dentin culture containing the spore-forming rod, from which *L. acidophilus* was not recovered.

The high incidence of L. acidophilus in the positive broth cultures indicates that this organism is definitely associated with the decalcification process in caries. The significance becomes even more impressive when one considers its frequency in pure culture. A higher incidence of mixed cultures in the superficial specimens than in the deep specimens indicates that the organisms present, other than *L. acidophilus,* were not more susceptible to our sterilizing procedure, but it represents the organisms actually present in the more superficial layers of decay in active caries.

To determine the probable etiologic relationship of the other organisms mentioned, the various genera and species isolated were checked for both acidogenic and aciduric powers. The only organisms that produced any appreciable amount of acidity, or were able to endure an acid broth of p_H 5.0, were the staphylococci and occasional strains of streptococci. *Staphylococcus albus* was present in only two instances. Its infrequency in this investigation, coupled with other previous bacteriologic studies of carious dentin that we have made, raises a question as to the probability that this genus plays an etiologic rôle in caries. While streptococci were frequently present in the superficial cultures, the majority of the strains isolated failed to grow in glucose broth of p_H 5.0. When transferred to acid broth of p_H 4.0, all strains were negative. The maximum acidity produced by these streptococcal strains was a final p_H of 4.7, and then in only two instances.

From experimental observation on the effects of acid broths, various p_H concentrations and broth cultures of aciduric organisms on the enamel of freshly extracted teeth by one of us (C. P. C.)

over a period of three years, we believe that in order to play an important part in the decalcification process, an organism must not only proliferate and survive in an acid medium of p_H 5.0, but also produce a final H-ion concentration greater than p_H 5.0. Enright and his co-workers,[7] in their investigative studies of the effects of acids on enamel, found that buffer solutions previously saturated with tricalcium phosphate etched enamel only to the most superficial degree, even after a sixty-day immersion in menstrums of p_H 5.0 or above, and concluded that the presence of organisms incapable of producing or tolerating a p_H less than 5.0 in the mouth could be definitely excluded as a potential cause of caries of the enamel. McIntosh,[8] in a study of the effects of acid broths on enamel, found that a concentration of acid greater than p_H 4.0 was necessary to affect decalcification. Thus, since only certain streptococcal strains produce, as their maximum, the minimum degree of acidity necessary to decalcify enamel, the relative infrequency of these strains in deep dentin cultures, together with the fact that streptococci do not possess marked aciduric powers, exclude them as important etiologic agents in caries.

The incidence of three mixed cultures in the deep dentin specimens and the two instances of positive cultures in which acidophilus organisms were absent do not contradict our previous statements. The organisms present in both these deep positive acidophilus-negative cultures were also recovered from the corresponding superficial cultures; one of the superficial cultures being acidophilus-negative, while the other contained a mixed growth of streptococci, gram-negative aerobic cocci and *L. acidophilus*. When the difficulty of arbitrarily dividing the carious material of a cavity into two parts is considered, together with the fact that the deeper dentin may become contaminated with organisms from the superficial area when the spoon excavator is forced through the carious dentin in obtaining the first specimen, a certain percentage of contamination is to be expected.

The incidence of ten negative cultures in the deep specimens, the corresponding superficial cultures of which were positive for *L. acidophilus*, probably resulted from the greater portion of the carious mass being removed in the first specimen. We have not been able to demonstrate satisfactorily the presence of micro-organisms in the deep decalcified zone; which leads us to believe that, in many cases, this area is sterile, *L. acidophilus* occupying an intermediary position from which its acids are liberated. This statement is not based entirely on our frequent negative cultures from deep dentin reported in this investigation, but also on the following information and investigative data: 1. While acidophilus organisms have the ability to produce relatively strong acid from fermentable substances and are capable of tolerating a high acidity, a medium of high H-ion concentration does not provide the optimum reaction for their cultivation. Morishita[9] found that the optimum reaction of mediums for the routine cultivation of the organisms to be about p_H 6.8. 2. Although most strains of *L. acidophilus* have the ability to produce a final p_H of from 3.8 to 3.0, or lower, after prolonged incubation in sugar broths, the initial employment of high acid broths for isolation of the organisms is not conducive to their growth; which indicates that the organisms have not become acclimated to such an acid environment. After isolation, and a number of

7. Footnote 1, second reference.

8. McIntosh, J.; James, W. W., and Lazarus-Barlow, P.: Brit. D. J., 43:728 (Aug.) 1922.

9. Morishita, Toshiki: J. Bacteriol., 18:181 (Sept.) 1929.

transfers, growth becomes more luxuriant in high p_H broths. 3. The hard unsoftened dentin between a carious cavity and the pulp chamber is often sterile on culture. This is contrary to the accepted belief that the dentinal tubules are filled with micro-organisms. If micro-organisms are present, as it would appear from histologic stained sections, they are apparently nonviable. One of us (C. P. C.) has, on many occasions, cultured the deep dentin after all decay has been removed, from teeth showing varying degrees of carious involvement, with nearly uniform negative results. 4. The pulps of carious vital teeth, free of periodontal disease, are often found sterile, even when softened dentin extends to the pulp chamber, provided sufficient decayed material remains in the cavity to prevent a direct exposure of the pulp to the oral fluids. 5. In an article, "Incidence of Pulpal Infection in Periclasia,"[10] by one of us (C. P. C.), in a total of forty-one carious teeth examined, *L. acidophilus* was not recovered from the pulp tissues in a single instance. We have only once isolated *L. acidophilus* from the pulp of a vital carious tooth. In this particular instance, cited in the article mentioned above, the cavity was extensive, softened dentin extending beyond the pulp chamber, although there was no direct exposure of the pulp. *L. acidophilus* was present in pure culture, no other organisms being present. 6. The deeper layers of decalcified dentin in active caries range in acidity from p_H 5.5 to 4.7. These p_H determinations were made colorimetrically, with the Lamotte H-ion testing set. Since this method is subject to error, we expect to make a future report from this laboratory on the acidity of carious dentin, as soon as suitable material becomes available, using the Beckman acidimeter. This is a new p_H glass electrode apparatus that has become available only recently. Accurate p_H determinations can be made on small amounts of material, which heretofore it has been difficult to accomplish by other methods. While the p_H of carious dentin does not approach the acidity actually produced by *L. acidophilus,* this is not to be expected. The acids liberated are partially neutralized as soon as the calcium salts of the tooth are dissolved, forming a buffered solution; which apparently establishes a final acidity of approximately p_H 5.0 in the deeper area of the decalcified mass. In superficial carious dentin, the acidity is less marked. The acids present become diluted, and further neutralized by the buffering substances present in the saliva, with formation of an area favorable for the colonization and growth of the ordinary mouth bacteria.

No attempt has been made in this report to relate in detail the controversial theories of dental caries. A number of investigators, Bunting,[11] Kesel,[12] Hatton,[13] Enright,[7] Noyes,[14] Bibby,[6] Rosebury[15] and others have critically reviewed the present-day literature.

SUMMARY AND CONCLUSION

1. In a bacteriologic study of the carious dentin of forty-four teeth, using

10. Canby, C. P.: J.A.D.A., 23:1871 (Oct.) 1936.

11. Bunting, R. W., et al.: Am. J. Dis. Child., 40:536 (Sept.) 1930. Bunting, R. W.: Facts and Fallacies in Our Concept of Dental Caries, J.A.D.A., 20:773 (May) 1933.

12. Kesel, R. G.: What Do We Know About Dental Caries? A Critical Review of Recent Investigations, J.A.D.A., 19:903 (June) 1932.

13. Hatton, E. H.: Caries—Résumé of Our Knowledge of Its Action, Together with Some of the More Recent Research Work, J.A.D.A., 19:1398 (Aug.) 1932.

14. Noyes, F. B.: Dental Caries: Review of Development of Century, J.A.D.A., 20:2119 (Dec.) 1933.

15. Rosebury, Theodor: D. Cosmos, 76:771 (July) 1934.

glucose-brain broth as the primary cultivating medium, in thirty-six instances sufficient material was present for culture from both the superficial and the deep dentin.

2. Eight teeth from which only one specimen could be obtained, and three from which two specimens, superficial and deep, were available, were negative. In these cases, with one exception, the carious lesions could be definitely classed as an arrested type.

3. *L. acidophilus* was present in 93.9 per cent of the superficial dentin positive broth cultures, and in 91.3 per cent of the deep dentin positive broth cultures.

4. In view of the findings reported, it is believed that the incidence of *L. acidophilus* has an important rôle in the carious processes.

5. The physical character of the decayed mass has an important influence on the presence of certain organisms, particularly *L. acidophilus*.

6. Although it is believed that, in many cases, a sterile area may exist between the deep carious mass and the pulpal floor, an inflammatory process may exist in the pulp tissue itself; which would affect the practical application of this belief.

7. The marked acidity of deep carious dentin, together with the presence of a zone of high H-ion concentration at the point of liberation of acids by *L. acidophilus* organisms, probably prevents the ingress of pathogenic organisms into the pulpal tissues of a tooth by way of the dentinal tubules in dental caries.

BACTERIAL TOXINS AND VITAMIN C IN RELATION TO TOOTH STRUCTURE*

By W. F. SWANSON, M.S., D.D.S.; A. SIGAL, M.S., and C. G. KING, Ph.D., Pittsburgh, Pa.

AN intimate relationship between vitamin C and tooth development has been demonstrated repeatedly. The earlier work, notably that of Zilva and Wells, Höjer, and Wolbach and Howe, has been reviewed with literature citations by Sherman and Smith.[1] Recent papers by Fish and Harris,[2] Hanke,[3] Day[4] and others have extended (and essentially confirmed) the earlier work. It is generally agreed that the level of vitamin C intake for normal tooth development is two or three times higher than the level for approximately normal body growth, and that the tooth structures are among the first to show histologic change when an animal is placed on a vitamin C-free diet.

*From the School of Dentistry and the Department of Chemistry, University of Pittsburgh.

*Contribution from the department of Chemistry, University of Pittsburgh. The authors are indebted to the Parke, Davis Co. and the Abbott Laboratories for a research fellowship grant (for A. Sigal) during the course of the investigation.

1. Sherman, H. C., and Smith, S. L.: Vitamins, New York: Chemical Catalog Co., 1931.

2. Fish, E. W., and Harris, L. J.: Tr. Roy. Soc. (London), 223:489, 1934.

3. Hanke, M. T.: Diet and Dental Health, University of Chicago Press, 1933.

4. Day, C. D. M.: D. Cosmos, 76:291 (March) 1934.

While studying the physiologic significance of intermediate levels of vitamin C intake, we have noted an additional and apparently new phenomenon that is important in relation to tooth development. Subcutaneous injections of diphtheria toxin were found to induce tissue injuries, previously recorded.[6]

In the present paper, we wish to record two observations: (1) that bacterial toxins may have an important rôle in causing injury to developing tooth structures without involving an actual infection of the tooth, and (2) that a high

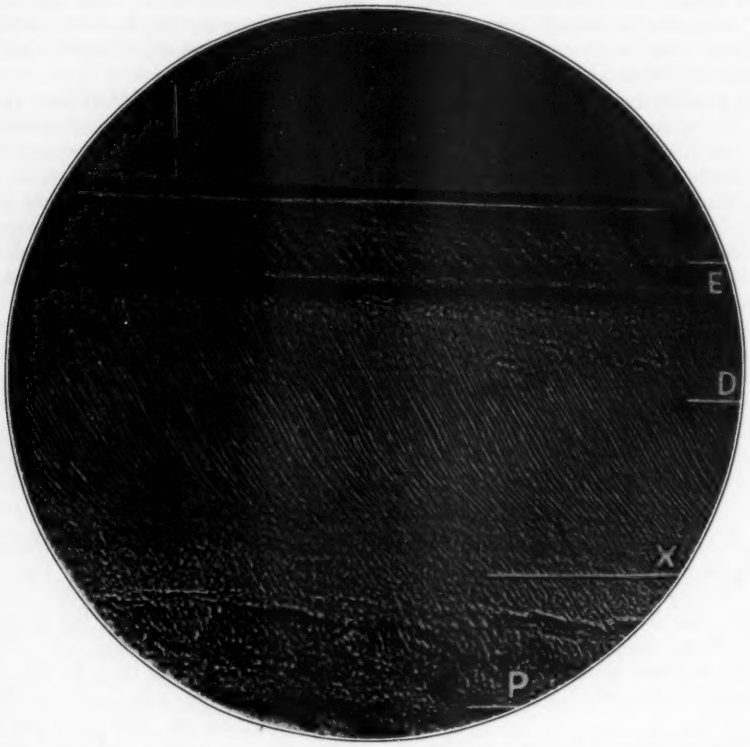

Fig. 1.—Section from animal receiving 0.9 mg. of vitamin C daily, without toxin. The enamel (*E*) is of uniform thickness and density, and the dentin (*D*) is nearly normal, although the dentinal tubules (*X*) are coarser and somewhat granular near the pulp (*P*).

macroscopic and histologic evidence of tooth injury in guinea-pigs, in addition to causing a depletion of vitamin C reserves from the body[5] and other vitamin C intake or nutritional level is important in relation to the natural pro-

5. Lyman, C. M., and King, C. G.: J. Pharm. & Exper. Therap., 56:209 (Feb.) 1936.

6. King, C. G., and Menten, M. L.: J. Nutrition, 10:129, 141 (Aug.) 1935. Bessey, O. A.; Menten, M. L., and King, C. G.: Proc. Soc. Exper. Biol. & Med., 31:445 (Jan.) 1934.

tection against such injury. In view of the fairly common incidence of a "prescorbutic" condition in human experience,[7] and the frequency of bacterial infections during the period of tooth development, we believe the finding reported here for guinea-pigs is important in relation to human tooth development. The relatively rapid and continuous growth of the teeth of the guinea-pig does not permit satisfactory study over long periods of time.

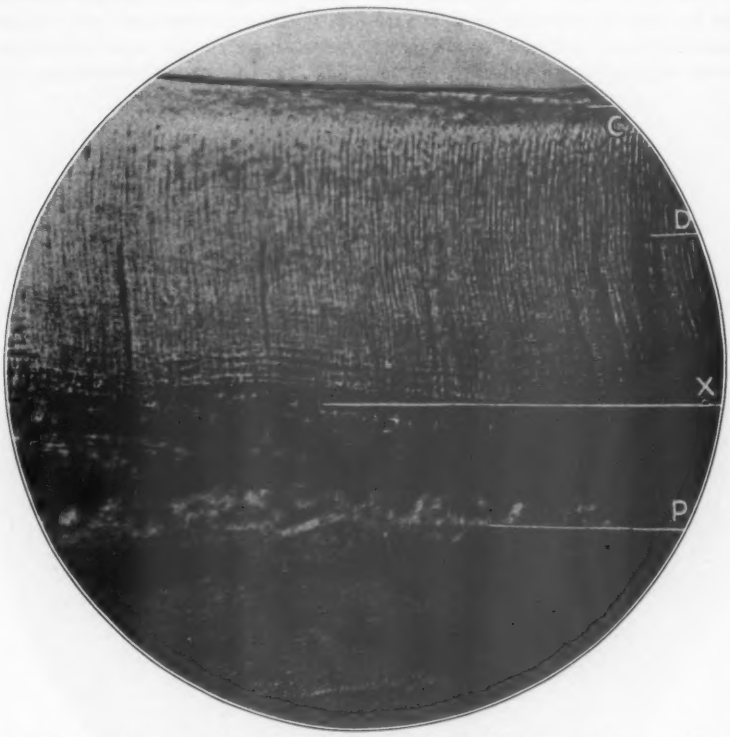

Fig. 2.—Section from animal receiving 0.9 mg. of vitamin C daily and one injection of 0.7 minimum lethal dose of diphtheria toxin. Four days after the toxin injection, the animal was killed. The section, from the lingual side of the tooth, shows a thin layer of cementum (*C*) and a fairly normal dentin (*D*) except for the disturbance (*X*) in the deposition of dentin near the pulp (*P*).

7. McCollum, E. V., and Simmonds, Nina: Newer Knowledge of Nutrition, New York: The Macmillan Co., 1929. Sherman, H. C.: Chemistry of Foods and Nutrition, New York: The Macmillan Co., 1932; Dalldorf, G., and Russell, H.: J. A. M. A., 104:170 (May 11) 1935. Dry, T. J.: Arch. Int. Med., 51:679 (May) 1933. Göthlin, G. F.: Skand. Arch. Physiol., 61:225, 270, 1931; Nature, 134:569, 1934. King, C. G.: Physiol. Rev., 16:238, 1936.

EXPERIMENTAL DATA

Guinea-pigs weighing about 250 gm. were placed in individual cages and

given a modified Sherman vitamin C-free diet, supplemented by spinach or crisp carrots, during a period of from ten to fifteen days, until normal growth was clearly evident. They were then given a standard solution of the pure vitamin daily and continued on the usual regimen followed in making vitamin assays for ten days previous to receiving toxin injections. The average weight at this time was 302 gm.

Figure 1 is typical for animals receiving 0.9 mg. of vitamin C per day without toxin injection. Figures 2-4 are typical for groups of animals receiving the same quantity of vitamin per day and given a single 0.7 minimum lethal dose subcutaneous injection of diphtheria toxin on the fourth, eighth and sixteenth days, respectively, before necropsy.

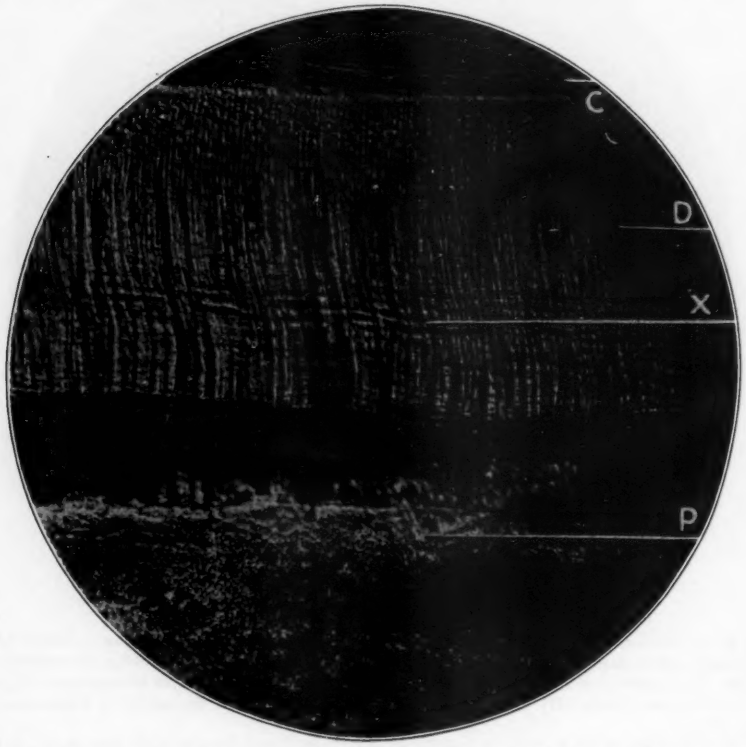

Fig. 3.—Section from animal receiving 0.9 mg. of vitamin C daily and one injection of 0.7 minimum lethal dose of diphtheria toxin. It was killed eight days after the toxin injection. The section, from the lingual side of the tooth, shows the cementum (*C*), dentin (*D*), pulp (*P*) and the region of disturbance (*X*) in the deposition of dentin.

Animals 500 gm. in weight receiving 0.9 mg. of vitamin C per day, and four injections of 0.3 minimum lethal dose of diphtheria toxin (Fig. 5) showed poorly

developed dentin, cementum and enamel. Control animals (no toxin) receiving 0.5 mg. of vitamin per day showed poorly developed dentin and enamel; while those receiving 0.9 mg. showed moderate deviation from the normal, and those receiving 2.0 or 3.0 mg. per day showed normal structures (Fig. 6).

they emerge from the gum tissue. Figures 1, 4 and 6 were taken on the labial or enamel side, while Figures 2, 3 and 5 were from the lingual or cementum side. (Magnification ×128.)

In an earlier experiment before arrangements were made for histologic study, animals (five in each group, body

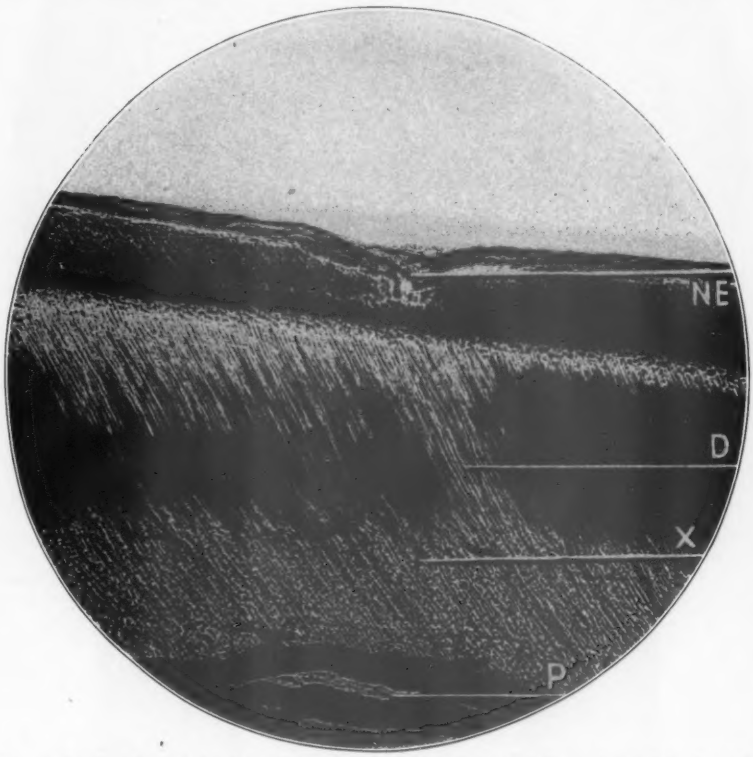

Fig. 4.—Section from animal receiving 0.9 mg. of vitamin C daily and one injection of 0.7 minimum lethal dose of diphtheria toxin. The animal was killed sixteen days later. The section, from the labial side of the tooth, shows one of several areas of hypoplastic enamel (*HE*) and evidence of disturbance (*X*) in the dentin (*D*).

The photomicrographs were made from ground sections of the left incisor teeth of guinea-pigs. The areas shown are from the regions of the teeth where

weight approximately 500 gm.) receiving 2.5 and 0.7 mg. of vitamin C per day were given two toxin injections of 0.4 minimum lethal dose each, on alternate

days. At the stage where the injured portions of the incisors extended slightly beyond the gums (about twenty-five days, in agreement with Fish and Harris,) all those on the low vitamin level plus toxin had broken incisors (Fig. 7); while none on the same level without toxin (Fig. 8), or on the high level, with

Fig. 5.—Section from animal receiving 0.9 mg. of vitamin C daily and four injections of 0.3 minimum lethal dose of diphtheria toxin. It died twenty-eight days after the last toxin injection. The section, from the lingual side of the tooth, shows a layer of granular cementum (*C*) and dentin (*D*) of such poor structure that it can barely be recognized.

(Fig. 9) or without toxin (Fig. 10), had broken incisors. It was this observation that led to the histologic study and further experimentation. The work is being continued with other bacterial toxins and with detailed histologic examinations.

SUMMARY

Guinea-pigs in the prescorbutic state are subject to marked injury to tooth structure from bacterial toxin (diphtheria) injected subcutaneously. The degree of injury is lessened when the animals receive a high vitamin C intake. The difference in degree of injury may be evident macroscopically, particularly in terms of tooth fragility and form, but

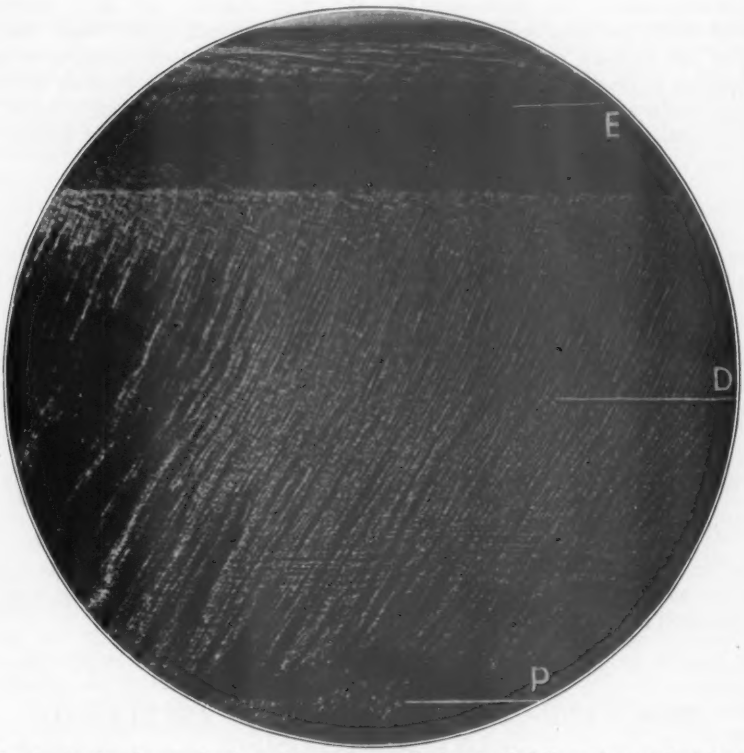

Fig. 6.—Section from animal receiving 2.0 mg. of vitamin C daily and no toxin injections. The section, from the labial side of the tooth, shows a dense layer of enamel (*E*) and a thick compact layer of dentin (*D*) extending to the pulp (*P*).

Fig. 7.—Teeth from animal receiving 0.7 mg. of vitamin C, and toxin. They are soft, irregular and broken.

Fig. 8.—Teeth from animal receiving 0.7 mg. of vitamin C and no toxin. They are soft and irregular, but not broken.

microscopic study of the tissues provides a much clearer and more sensitive indication of the changes induced. Marked granulation of the dentin and hypoplastic enamel resulted from receiving 0.7 minimum lethal dose of diphtheria toxin when on a 0.9 mg. vitamin C level, in contrast to the mild deviations which were evident in the control (no toxin and 0.9 mg. vitamin per day) animals.

It is apparent, from these results, that the systemic effects of infections may play an important rôle in tooth development without involving an infection in the immediate tooth areas. Lesions of this type may be considered as secondary to disturbances in general cellular function.

Fig. 9.—Teeth from animal receiving 2.5 mg. of vitamin C and toxin. They are nearly normal, but occasionally irregular.

Fig. 10.—Teeth from animal receiving 2.5 mg. of vitamin C and no toxin. They are normal.

SCHÜLLER-CHRISTIAN DISEASE (SKELETAL XANTHOMATOSIS)*

By JOSEPH SCHROFF, M.D., D.D.S., New York City

WITH the steady advance in medical knowledge, the close relationship between medicine and dentistry becomes more self-evident, and it behooves the dentist, and especially the oral surgeon, to keep up with this advancement in order to best serve the patient.

As an illustration of this statement, one might cite the condition of "osteitis fibrosis cystica," which occurs frequently in oral practice. Within recent years, the true nature of this disease has been elucidated, and we know now that these areas of decalcification within jaw bones are but one manifestation of the generalized systemic process called hyperparathyroidism. Along with clarity as to its pathology came also the means to detect its presence by noting the changes in the chemical content of the blood, i.e., in the

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calcium and phosphorus, and, finally, of greater importance, proper treatment followed, in this case being directed toward the parathyroid glands.

Schüller-Christian disease to many practitioners may be but a medical curiosity or, at best, but remotely connected with oral practice. Yet the disease is one that the oral practitioner should be vitally interested in, since oral manifestations are seen early in many of the cases, and it is to the dentist that the patient is most likely to go for relief of symptoms.

Recently, I had the opportunity of studying a case which I feel justified in calling to the attention of the dental profession:

History.—M. T., a woman, aged 23, an American, gentile, occupation, night-club singer, had recently been under the treatment of a dentist for stomatitis, which was diagnosed as Vincent's infection. After eliminating this condition, the dentist noticed that a lower molar tooth was very loose and the jaw somewhat swollen. Roentgenograms of the jaws revealed what appeared to be a cyst. About one year previously, the patient had had pain in the lower right first molar tooth, which was treated, but subsequently extracted. The socket remained "infected" for some time, and later a swelling developed in the lower jaw. In June, 1935, roentgen-ray examination revealed scattered areas of decalcification, which were diagnosed, preoperatively, as cysts. Since the operation, she had had occasional recurrences of swelling of the right mandible. Several weeks previously, ulcerations in the mouth and gums accompanied by pain developed. Aside from the jaw condition, there were no other complaints.

Little information could be elicited. After much questioning, the patient recalled that she had been thrown from a horse two years previously, striking her jaws. She did not suffer any fractures.

Examination.—The patient was well-developed and well nourished. A very slight asymmetry of the right mandible was noticeable. All the teeth were present except the lower right first molar. They were normal in appearance, but some were freely movable. They responded to the electric pulp tester. A soft subperiosteral swelling was present on the right side of the mandible.

A lateral roentgenogram of the mandible revealed extensive destruction of the jaw bones (Fig. 1), with a pathologic fracture.

I immediately informed the patient and the dentist that intensive study was necessary to diagnose the condition. My first thoughts were to rule out any constitutional disease which, if present, would obviate local surgical inference and thereby avoid the loss of the jaw bone, an economic factor in her occupation. The patient agreed to this and was warned against becoming impatient.

At the time, I considered the following possibilities: (1) recurrence of the cyst after extensive operation, (2) adamantinoma, (3) tumor of a destructive nature (sarcoma) and (4) hyperparathyroidism.

The patient was at once referred to a roentgenologist for a roentgenogram of skull and skeletal bones for any further evidence of bone destruction. His report noted no abnormalities in the skull, scapula, humerus or ribs. Unfortunately, the pelvis and lower extremities were not examined. His diagnosis was "adamantinoma or tumor."

I then referred the patient for a complete medical examination with special reference to blood chemistry and a recheck on the roentgenograms of all the skeletal bones. An impression for a splint to stabilize the jaw was taken at this time.

The pupils reacted normally to light and in accommodation. There were areas of brownish discoloration over the teeth in the upper jaw. The tonsils were enlarged, but not diseased. There was moderate swelling of the soft tissues about the right side of the mandible and slight tenderness along the ramus on both sides. The right side of the mandible felt slightly irregular.

There was no thyroid or glandular enlargement. The lungs were clear. The heart was not enlarged, the sounds were of good quality and there were no murmurs. The liver and spleen were not palpable. No masses nor areas of tenderness were detected. The rectal examination was negative. The reflexes were active and equal. No pathologic reflexes were noted. The blood pressure was: systolic, 112; diastolic, 80.

Fluoroscopy of the chest showed that the heart and lungs were negative. A blood examination, March 3, 1936, revealed the following: hemoglobin, 88 per cent; leukocytes, 15,200, of which the polymorphonuclears were: segmented, 72 per cent, and staff, 4 per cent; lymphocytes, 19 per cent; monocytes, 5 per cent. March 5, the leukocytes numbered 8,500, of which the polymorphonuclears were: segmented, 68 per cent, and staff, 2 per cent; lymphocytes, 27 per cent, and monocytes, 1 per cent.

The sedimentation time of the red blood corpuscles was two and one half hours (normal).

The Wassermann and Kahn tests were negative.

The urine was cloudy and acid. There was no albumin and no sugar. The specific gravity was 1024. There was a moderate number of leukocytes and many epithelial cells.

The basal metabolic rate was —3 (normal).

The blood calcium was 10.8 mg. per cubic centimeter (normal, 9.2 to 11 mg.). The blood phosphates were: 3.7 mg. per cubic centimeter (normal, 2.7 to 4.2 mg.). There were 6 King Armstrong phosphatase units (normal).

The results of the blood chemistry tests ruling out hyperparathyroidism, the conclusion was reached that the condition was most probably a cyst or adamantinoma.

As no roentgenograms of the skeletal bones were taken, I communicated with my patient to refer her back to the hospital for the roentgen-ray examination. She informed me that she had gone to another oral surgeon in town for consultation and decided to remain in his care.

Fig. 1.—Extensive area of decalcification of mandible (February, 1936).

During this interval, I had written to the oral surgeon in the Midwest who had operated on the patient because of the cyst, requesting some details as to his findings. He graciously sent me the roentgenograms taken at the time, together with the pathologist's report on the tissue, which was diagnosed as "undiffer-

entiated sarcoma." (Fig. 2.) His letter also informed me that because the patient had gone to New York, he had referred her to the Memorial Hospital for treatment. The true diagnosis was not revealed to her, but the patient promised him that she would go there immediately. The roentgenograms and the report were forwarded to the hospital. Unfortunately, the patient never applied for treatment. The condition apparently had not troubled her until recently. When her mouth became sore again, she went to a dentist, hiding from him the fact that she had been referred to the Memorial Hospital.

After studying the roentgenogram taken in August, 1935, I was still puzzled and requested the opportunity of studying the microscopic slide. A piece of the tissue removed at the time was sent me and I sectioned it. Various opinions as to the diagnosis, such as "myeloma" and "syphilogranuloma," were made. The diagnosis of Schüller-Christian disease was made by Paul Klempere, of Mt. Sinai Hospital.

About this time, I learned that the patient had been operated on. The condition had been diagnosed as a radicular cyst without any consideration of the possibility that it might be a constitutional disease. The biopsy report was "chronic inflammation."

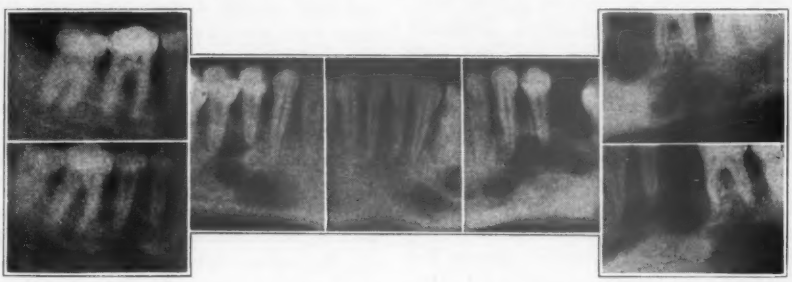

Fig. 2.—Diffuse areas of decalcification of mandible (August, 1935).

THE LITERATURE

Schüller-Christian[1] disease belongs to the group of diseases characterized by a constitutional disturbance of lipoid metabolism that leads to an overflow of lipoid substance into the blood. In an effort to rid the blood of excess lipoid, certain cells of the reticulo-endothelial and histiocytic system ingest and store the fats. The areas so affected become the site of granulomatous masses resembling malignant tumors and, because of their destructive influence on certain organs and tissues, a characteristic clinical syndrome is produced. The presence of these granulomatous masses in bone causes a local osteoporosis, due to direct pressure of the masses on the trabeculae. In the soft tissues and organs, the lipoid infiltrates the parenchyma and interferes with the functions of these organs. In addition, the presence of free lipoid in the tissues evokes an inflammatory cellular reaction as well as a secondary proliferation in the tissues, resulting in fibrosis or a reaction similar to that produced by the presence of any foreign substance. These

1. Rowland, R. S.: Am. J. Roentgenol. & Radiol., 30:649 (Nov.) 1933; Arch. Int. Med., 42:611 (Nov.) 1928.

three phenomena blend and constitute the typical lipoid granuloma, or storage-cell tumor, the elements of which are varied only by the rapidity and location of the process.

On gross examination, the granulomatous masses appear fatty on section and have the consistency of putty. Microscopically large collections of large vacuolated cells are found, each 20-80 mm. in diameter, and often referred to as foam cells. These cells do not undergo cell division, but simply act as store houses, joining with other cells to form tumor masses.

The clinical picture is variable, depending on the type of lipoid at fault, the acuteness of the process and the location of the lipoid granulomas. Different clinical entities have been described, such as (1) Gaucher's disease, in which kerosin, a phosphorus-free cerebroside, is the lipoid at fault. A type occurring at any age, but chiefly in children, and in which the spleen and liver are usually enlarged; (2) Nieman-Pick disease, in which phosphated lecithin is the lipoid at fault, this type resembling Gaucher's disease, but occurring in Jewish infants and following a more intense and a fatal course; (3) Schüller-Christian disease, in which cholesterol and its esters are the lipoid at fault; (4) skin types with or without diabetes, icterus and pregnancy, and (5) essential xanthomatosis.

The only group of particular interest to us is that of Schüller-Christian. Various names have been used in the literature describing this condition, such as "Hand-Schüller-Christian's disease," "Schüller's disease" and "Christian's syndrome."[2] A second group of titles, designated to include its etiology or pathology, designate "lipoid granulomatous xanthomatosis," "lipoid histiocytosis," "skeletal lipoid granulomatosis" and "reticulo-endotheliosis," etc.

Clinically, the first cases described in the literature were diagnosed late in the course of the process, and since most of these manifested (1) decalcification of the bones, especially the skull; (2) exophthalmos, and (3) diabetes insipidus, these symptoms come to be called the "Christian triad" and were considered essential in making the diagnosis. As further cases were recognized and studied, it was pointed out by Henschen,[3] and then by Sosman,[4] that it was not necessary for the "triad" to be present, but that one major symptom alone might appear early and that, as the disease progressed, the other signs would appear. Henschen emphasized this to the extent that he grouped the cases reviewed by him in eight different combinations of one, two or three symptoms.

Another advance in thought and point of view appeared with the recognition that membranous and flat bones in any part of the skeleton might be the site of the beginning process. In addition to the skull, similar changes might occur in the maxilla, mandible, pelvis, ribs, femora, etc. These bone defects might have the same irregular moth-eaten appearance and sharply defined borders as were observed in the skull. Smith[5] showed, in his series of cases reviewed, that the jaw bones were involved in about 25 per cent of the cases.

Lyon and Meyer[6] emphasized the

2. Christian, H. A.: Defects in Membranous Bones, Exophthalmos and Diabetes Insipidus; Unusual Syndrone of Dyspituitarism, M. Clinics N. America, 3:849 (Jan.) 1919.

3. Henschen, F.: Acta Pediat. (Supp 6) 12, 1931.

4. Sosman, M. C.: Am. J. Roentgenol. & Radiol., 23:581 (June) 1930; J.A.M.A., 98: 110 (Jan. 9) 1932.

5. Smith, J.: Schüller-Christian Disease, Radiology, 24:521 (May) 1935.

6. Lyon, E., and Meyer, H.,: Clinical Appearance of Mouth in Schüller-Christian Disease, Ztsch, f. Kinderh., 49:768, 1930.

early findings of oral lesions, such as gingivitis, the gums being spongy, swollen and tender and the teeth, detached from the gums, becoming loose and often spontaneously extruded. A foul breath was not an infrequent occurrence. Dauksys,[7] in reviewing 123 cases, found oral symptoms present in twenty-three cases (about 18 per cent).

The loosening of the teeth is due to the fact that granulomatous fatty tissue replaces the bone and actually displaces the teeth. Subperiosteal semisoft swelling replaces the bony contour of the mandible and maxilla. Fraser,[8] in his article, shows a colored photograph of a tooth with lipoid material adhering to the root. Often cholesterin, expressed from around the necks of the loose teeth, is mistaken for pus. Dalitsch,[9] in describing and adding his case to the literature, also comments on the oral lesions that were present early. His patient had constant pain in the jaw, with loosening of the teeth and multiple defects in the mandible occurring fully two years before the area of decalcification appeared in the femora. His patient also had diabetes insipidus and proptosis. The interoral dental films of his case resembled those in Figure 2, while the lateral roentgenogram showed the same extensive destruction as Figure 1. The time interval was approximately two years longer.

Schaefer and Williams[10] described a case in a Jewish woman, aged 30, who had exophthalmos and diabetes insipidus and who had been operated on for a cyst of the jaw. This case had been treated by several dentists without their recognizing its true nature.

From the standpoint of treatment, the best results obtained were those in which roentgen therapy was used. (Sosman,[4] Radding.[11]) Occasionally, spontaneous cures were noted.

COMMENT

The case here presented was that of an American woman, aged 23 years, with early mouth lesions, who had been operated on for a cyst of the jaw. She presented an extensive destruction of the mandible. The diagnosis was made by examination of the biopsy material removed at the first cyst operation.

The case here presented differs from the others in the literature from the fact that it occurred in an American gentile, and that the jaw bones were the only areas involved. Exophthalmos and diabetes insipidus were not present. It is recognized now that race, geography and heredity play no rôle in the disease.

The picture of the roentgenographic findings is characteristic and resembles that seen in Dalitsch's case and in Schaefer and Williams' case.

While the diagnosis was made fairly early in comparison with other cases in the literature, it also was missed by those who first examined the patient becaure of their unfamiliarity with the disease and its symptoms.

The variations in the pathologist's reports noted here, as in other cases, is also explained by the unfamiliarity of pathologists with the varying phases of the process.

7. Dauksys, J.: Xanthomatosis—Schüller-Christian, J. Missouri M. A., 66:466 (Dec.) 1935.

8. Fraser, J.: Skeletal Lipoid Granulomatosis, (Hand-Schüller-Christian's), Brit. J. Surg., 22:800 (April) 1935.

9. Dalitsch, W. W.: Xanthomatosis, Illinois M. J. 63:131 (Feb.) 1933.

10. Schaefer, J. E., and William, P. E.: Schüller-Christian Disease, D. Cosmos, 74:879 (Sept.) 1932.

11. Radding, M. B.: Schüller-Christian Disease After X-Ray Therapy, Living and Under Observation Eleven Years, Radiology, 24:591 (May) 1935.

SUMMARY

Schüller-Christian disease, formerly considered a rare or infrequent condition, is a constitutional disease of utmost importance to the oral practitioner.

Early evidence of the condition may occur in any membranous or flat bone such as the jaw bone. It is only when the process extends to the skull bones and invades the surrounding tissues that the symptoms of exophthalmos and diabetes insipidus appear.

The case here reported presented only the early oral manifestations: pain in a tooth, multiple areas of decalcification in the mandible, stomatitis and looseness of vital teeth. The importance of early diagnosis based on examination of pathologic tissue is emphasized, especially since deep roentgen therapy offers the greatest hope for a successful outcome when used early in the course of the disease.

The need for thorough and intensive study of all cases should be so self-evident as not to require reiteration. Constitutional diseases should always be kept in mind.

ADULT ORTHODONTIC THERAPY: A PRACTICAL AID TO THE GENERAL PRACTITIONER*

By EARL F. LUSSIER, D.D.S., San Francisco, Calif.

THE wide publicity given modern orthodontic advancement has created an ever-widening demand for orthodontic service and has at last resulted in the demand of the adult for aid.

The adult patient, owing to the loss of one or more of the permanent teeth early in life, presents varying degrees of dentofacial deformity. The dentist is expected to advise these patients and is frequently asked to treat them.

It is important to note that the presence of these deformities in adults interferes, precisely as much as in children, with the exercise of the function of the teeth and tends to the development of other affections.

NORMAL OCCLUSION

The importance of normal dental function because of its influence on the facial features and its relation to health and well-being is well known to the dentist. A study of modern dentistry discloses the fact that normal occlusion plays a very important rôle in the maintenance of oral health. In periodontoclasia, the periodontist attempts to eliminate the greatest single causative factor, traumatic occlusion. In prosthetic dentistry today, the problem of tooth and jaw anomalies is met precisely as are other problems. No longer are prosthodontists restoring the human denture in a haphazard manner. They realize that it is useless to make a dental restoration that is badly out of alinement and out of function. Thus, the demand for adult orthodontic assistance has been created by modern dentistry.

HISTORY OF ADULT TOOTH MOVEMENT

Thirty years ago, the correction of any dental anomaly was usually postponed to the fourteenth year, and seldom were pa-

*Read before the Section on Orthodontia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

tients treated after the age of 20. With the adoption of diagnostic classifications and standardized methods of treatment, many practitioners treated cases earlier and many cases were accepted after the age of 20, though it was commonly understood that patients over 30 should not be treated. In the past ten years, the subject of adult treatment has taken on a different aspect. No longer is the anomalous condition of the adult felt to be a hopeless one, but through a broader comprehension of the problems involved, greater assistance has been rendered by the orthodontist.

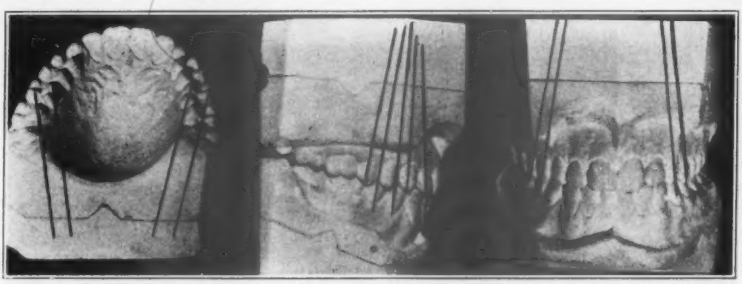

Fig. 1.—Cephalometric gnathostatic plaster denture reproductions (to judge the denture in three dimensions).

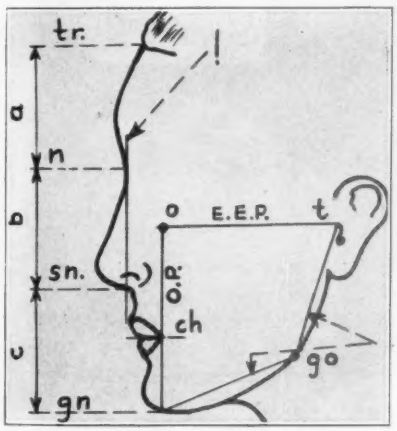

Fig. 2.—Dentofacial relations (as shown in photostatic profile photograph).

Fig. 3.—Treatment of abutment teeth in preparation for orthodontic therapy.

MINOR AND MAJOR GROUPS

To simplify the discussion of these adult cases, the classification of the structural lesions and functional disturbances of the face and jaws into two groups is suggested; namely, minor and major. The minor group comprises the anomalies of tooth eruption, number, position, form and structure, minor maldevelopments of the alveolar process, diminished masticatory function and consequent increased predisposition to dental caries, as well as the associated abnormalities of the labial frenum and gingivae. In the major

groups are included malrelation of the dental arches, faulty articulation in speech and such serious conditions as arrest general physical and mental development.

DIAGNOSIS

The anomalous adult case presents a great variety of unfavorable conditions. The average diagnosis rarely takes these unfavorable conditions thoroughly into account. When a dentist makes an examination, he goes through a process of making a diagnosis, which may not be thorough or scientific, but it is a diagnosis nevertheless. Instead of doing this recording in a scientific and orderly manner, he often does it haphazardly. To be successful, to the extent that the word is going to mean in the future, it is necessary that we study our cases from every angle and finally arrive at a definite diagnosis. Necessary to such a study is not only a thorough roentgenographic survey, but also cephalometric plaster reproduction of the denture in three dimensional orientations as well as photostatic facial reproductions similarly orientated. The gnathostatic system of diagnosis fulfils these demands. Every dentist is doing a thousand things far more difficult than taking a photostatic photograph and mak-

Fig. 4 (Case 1).—Minor case.

Fig. 5 (Case 2).—Major case.

Fig. 6 (Case 3).—Major case.

ing a gnathostatic model, and it is, I believe, necessary for all dentists to use three dimensions, which is the only right way. (Fig. 1.) The dentofacial relations

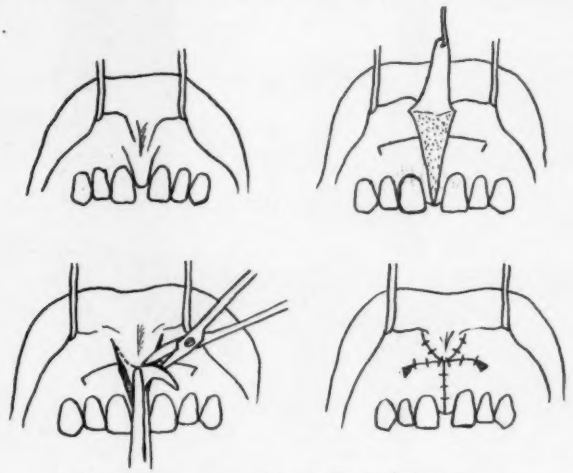

Fig. 7.—Frenum operation, Group 1; bulky frenum.

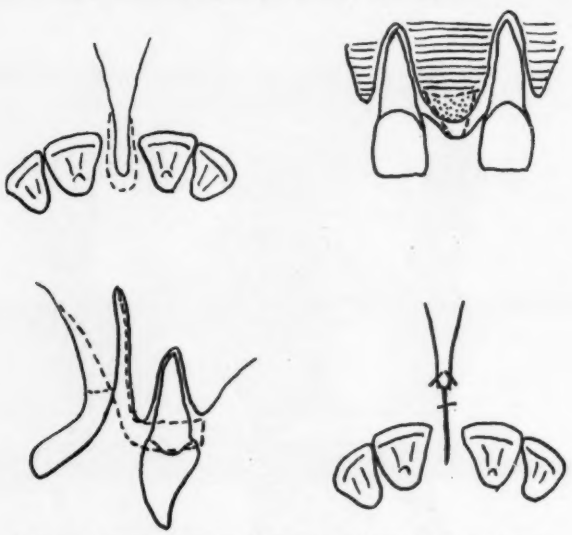

Fig. 8.—Frenum operation, Group 2, moderately bulky frenum.

cephalometric gnathostatic methods, because it is possible to judge the denture in are also considered in an exact manner. (Fig. 2.) The gnathostatic system of

diagnosis merely tries to encompass, in a scientific manner, that which it is possible to grasp scientifically. Every practitioner is left to draw on his own experiences and to determine the method and therapeutic aim.

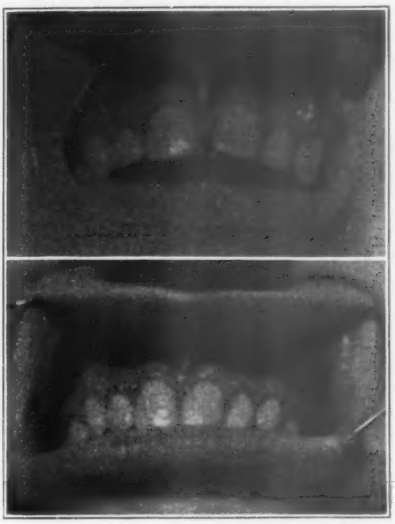

Fig. 9 (Case 3).—Frenum operation, before (above) and after (below).

THERAPY

Men and women from 20 to 50 years of age are often deeply conscious of irregular and unsightly teeth. They have developed displeasing contortions of the muscles of the face in the efforts to conceal the defects. Not only their chance for full success in life is jeopardized, but also successful care of their mouths by their dentist is made impossible. In the past, these patients were advised that, on account of their age, nothing could be done. This, of course, is not so. We have it on the authority of many prominent

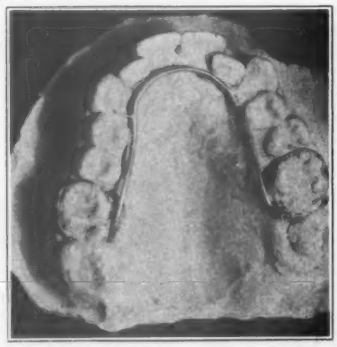

Fig. 11 (Case 4).—Maxillary appliance.

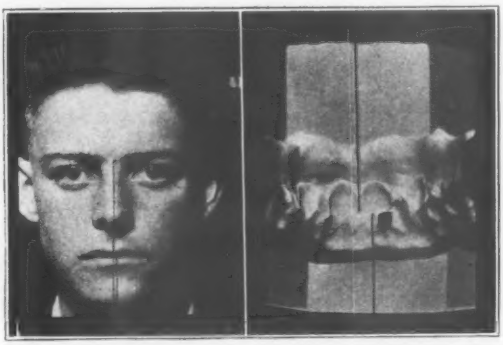

Fig. 10 (Case 4).—Laterally placed mandible.

orthodontists that it is entirely feasible to bring about beneficial changes in the teeth and jaws of the adult patient by means of orthodontic treatment. Age is no barrier.

Therapy in adult cases might conveniently be divided into: (1) muscle exercises, therapy that is finding use in most cases; (2) surgical measures, such as the operation on the frenum and gingivae, the extraction of teeth, the removal of cysts and, in severe cases, the resection of the mandible, and (3) mechanotherapy,

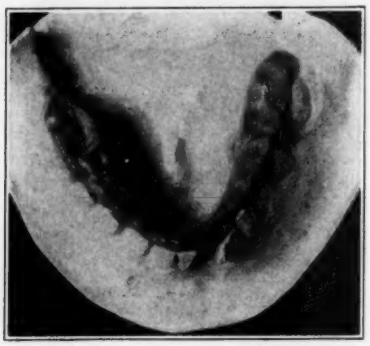

Fig. 12 (Case 4).—Mandibular splint.

operation of the dentist and the orthodontist is desired. In all instances wherein a permanent restoration is to be made by the dentist on completion of the orthodontic work, abutment teeth should first be prepared and a temporary prosthesis

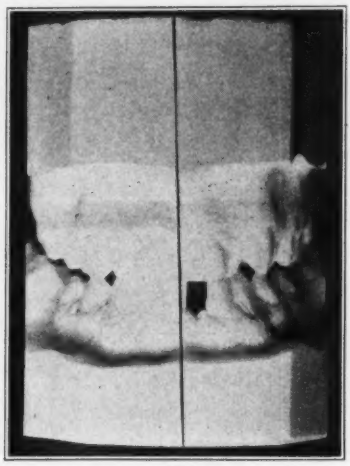

Fig. 13 (Case 4).—Occlusion as it appeared when mandible was shifted to normal median plane by aid of splint.

Fig. 14 (Case 4).—Condition before and after use of splint.

which is divided into the use of: (*a*) splints, (*b*) active appliances and (*c*) passive appliances or retainers.

In all cases of adult treatment, the co-

should be cemented in with oxide and eugenol cement. There are three important reasons for this procedure: First, the preparation of the abutment teeth after

orthodontic treatment necessitates the removal of the orthodontic appliance during this time and might result in altering their position. Secondly, the preparation of the abutment is less painful if it is done before movement of the teeth, and, thirdly, the prosthesis can be immediately finished and placed, thus acting as a retainer. (Fig. 3.)

An illustration of the handling of the therapeutic problem for adults will be shown in the presentation of reports of cases selected to represent examples of the different divisions under the minor and major groups.

The first report selected is that of a minor case—an anomaly of tooth eruption plus an associated abnormality of the gingivae.

REPORT OF CASES

CASE 1.—A woman, aged 35, had a partially erupted right maxillary cuspid in a nearly normal position, but prevented from complete eruption by the drifting mesially of the first bicuspid. The second bicuspid had been lost. There was present over the cuspid hypertrophied gum tissue, and there was formation of a slight pocket on the distal aspect. (Fig. 4.) The therapy employed was both surgical and mechanical. The hypertrophied tissue was completely

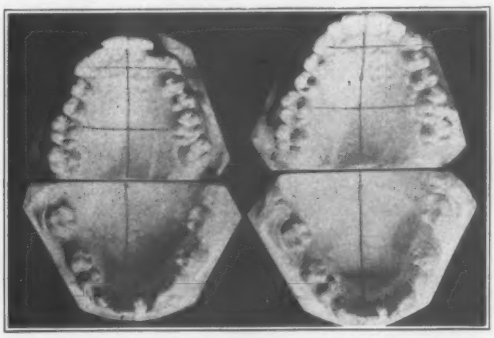

Fig. 15 (Case 4).—Condition before and after use of splint; occlusal view.

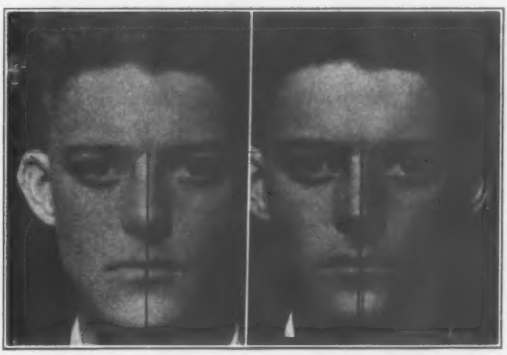

Fig. 16 (Case 4).—Condition after and before use of splint.

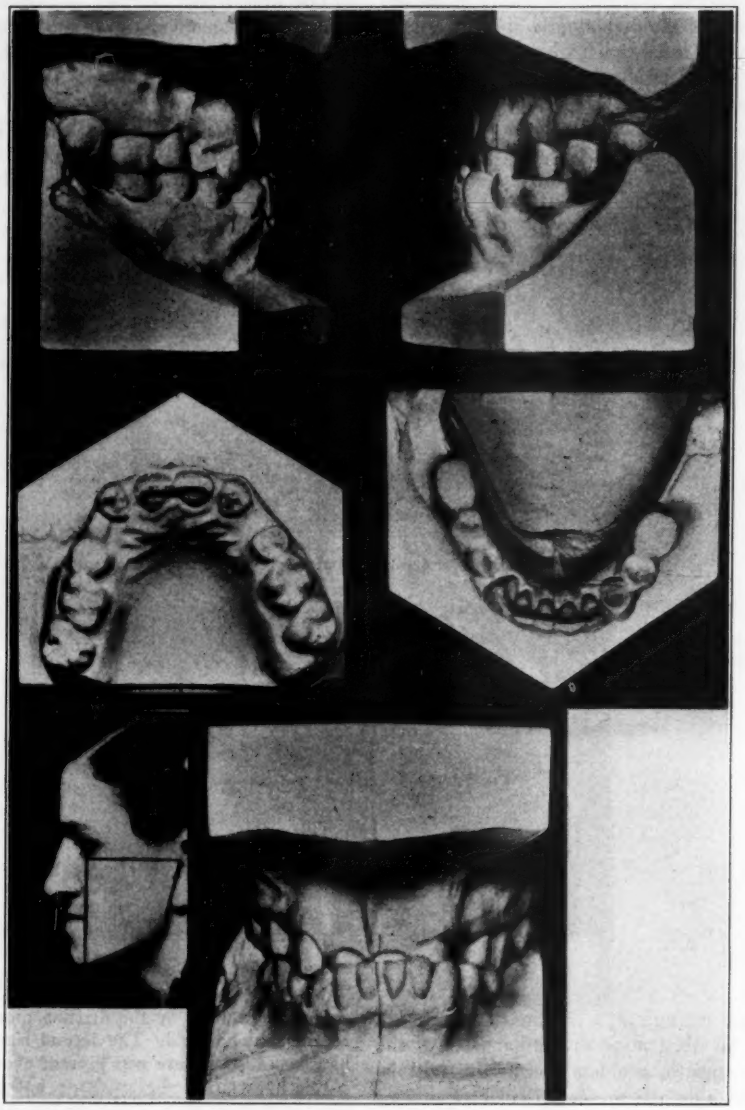

Fig. 17 (Case 5).—Gnathostatic plaster denture reproduction and photostatic facial reproduction before orthodontic therapy.

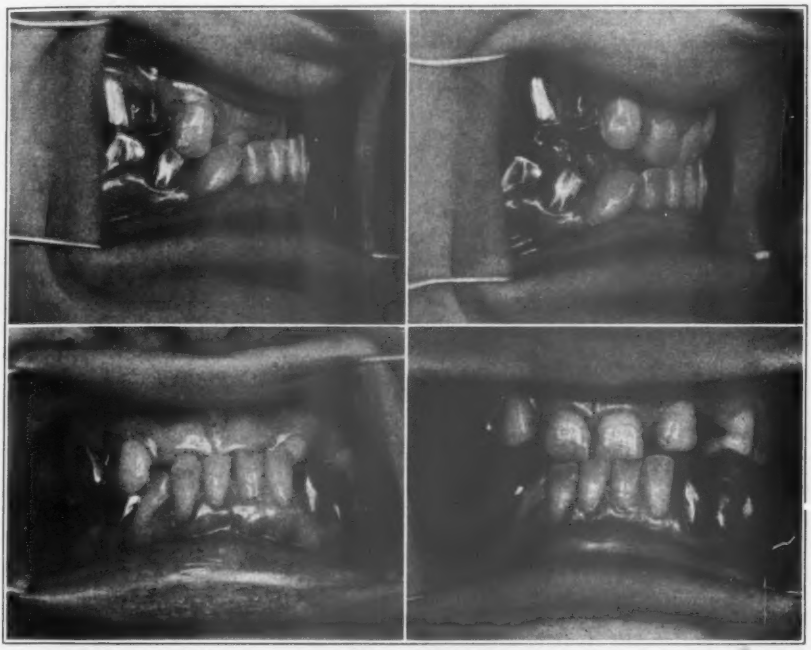

Fig. 18 (Case 5).—Intra-oral photograph showing cantilever bridges before orthodontic therapy.

Fig. 19 (Case 5).—Condition before orthodontic therapy.

removed. This measure exposed more of the cuspid crown and permitted cementing a small brass hook on the crown with black copper cement. The right first bicuspid and right lateral incisor were banded. No. 0.020 round tubes were soldered on the buc-

cal surface of the bicuspid band and labial surface of the lateral band. A lingual extension 0.030 inch round wire was soldered to the lingual gingival surface of the lateral band and extended mesially, lying in contact with the lingual gingival surface of the central incisors. This extension prevented a displacement of the lateral incisor during treatment. A 0.020 round labial arch wire was so bent between the bicuspid and lateral incisor that when the bent portion was opened, pressure could be exerted in a distal direction on the bicuspid. The absence of the second bicuspid permitted rapid movement of the first bicuspid, and the cuspid was brought down by ligation from the arch to the hook. When the

Fig. 20 (Case 5).—Orthodontic appliance.

cuspid had fully erupted, the hook was removed and a band with a spur attached was cemented and the tooth was rotated slightly. No retention was necessary.

The second report is that of a major case, a malrelation of the dental arches resulting in lack of room for the normal eruption of the maxillary cuspids.

Case 2.—A woman, aged 35, had the maxillary cuspids locked out of occlusion. This cuspid prominence caused a great deal of embarrassment to the patient. The therapy employed was again both surgical and mechanical. (Fig. 5.) Extraction of the second bicuspid afforded enough room to move the cuspids distally and downward. The mechanical therapy consisted of banding the maxillary first molars, on the buccal surface of which were soldered 0.040 round tubes. A lingual arch was also used for stabilizing the molars and, with 0.020 inch round wire finger springs attached, permitted the movement distally of the first bicuspids, giving room for the cuspids. A 0.040 round labial arch wire was used, with soldered extension finger springs of 0.020 round wire, the cuspids gradually moving distally and downward. No retention was necessary in this case.

The third report selected was also a major case, a mandibular retraction plus

Fig. 21. (Case 5).—Orthodontic appliance.

a collateral abnormality of the labial frenum.

Case 3.—A woman, aged 25, had a slightly receding chin and a large frenum, with resultant separation of the maxillary central incisors. (Fig. 6.) The therapy employed was both surgical and mechanical as well as muscle exercises. The surgical therapy consisted in an operation on the frenum *(not* removal of the frenum).

Frena may be divided into two groups. The first group are extremely bulky and with low lip attachment. The operation on this type is more of the plastic type, necessitating, in some instances,

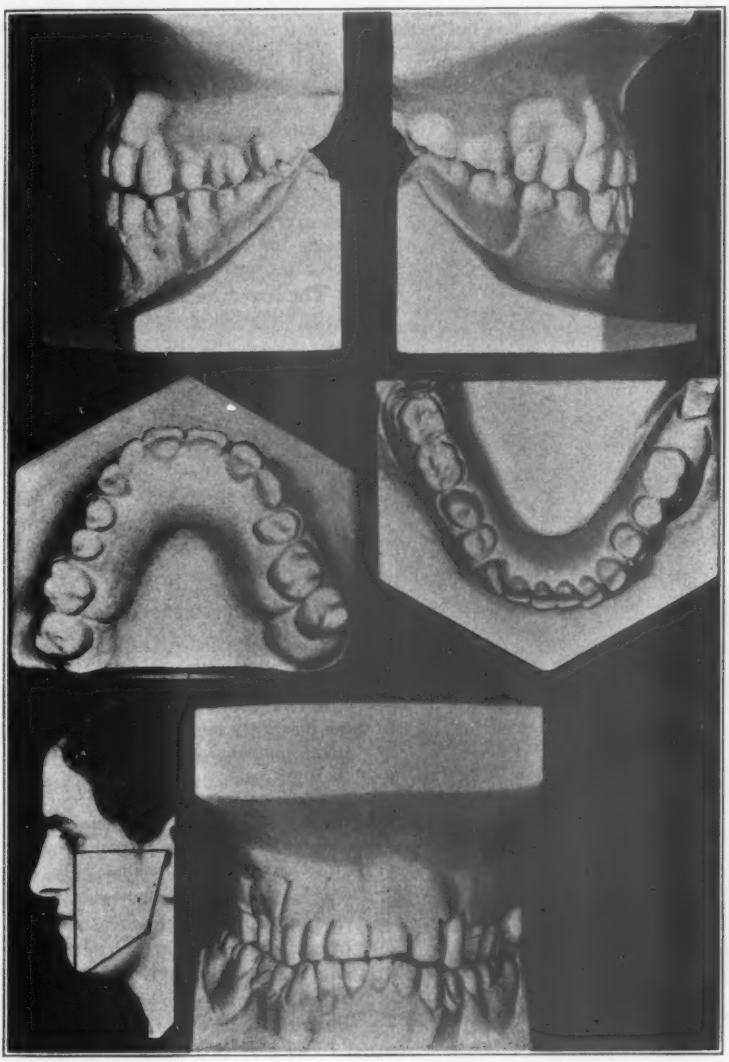

Fig. 22 (Case 5).—Gnathostatic plaster denture reproduction and photostatic facial reproduction after orthodontic therapy.

the trimming down of the nasal spine. (Fig. 7.)

The second group are less bulky and are met with more frequently. The lip attachment is not so distorted as in the first group. The operation consists of two

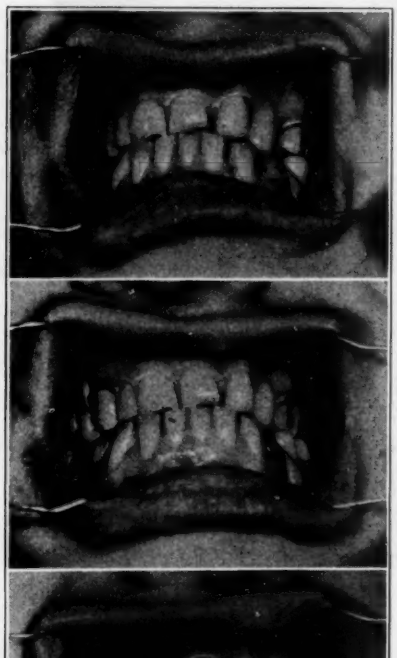

Fig. 23 (Case 5).—Intra-oral photographs after orthodontic therapy.

central incisions coming together on the lingual aspect between the two central incisors and dissecting out the fibrous band attached to the bone, cutting off the fibrous band and suturing the stump on the labial aspect, forming a new attachment for the frenum. (Fig. 8.)

Both the maxillary and the mandibular appliances consisted of a labial and a lingual arch. (Fig. 6.) They were adjusted and intermaxillary rubber bands were used. Retention was obtained by the use of a maxillary Hawley plate retainer and the passive use of the lower lingual arch. Muscle exercises were continued. Figure 9 shows the frenum of Case No. 3 before and after operation.

The fourth report illustrates the use of a vulcanite splint as a mechanical aid in treatment. The case is a major one, complicated by a lateral displacement of the mandible.

Case 4.—A man, aged 20, had a displacement of the mandible to the left (Fig. 10, left), resulting in a total lack of occlusion. (Fig. 10, right.) Only a few cusps occluded.

Mechanical therapy, divided into two parts, was used.

First, a vulcanite splint was employed to force the mandible to a normal centric position, permitting a quick adjustment of the maxillary arch by means of a lingual appliance. (Figs. 11-13.)

In two months, enough widening between the maxillary molars was obtained that the splint could be dispensed with. (Figs. 14-16.)

The case was treated subsequently with a prosthesis made by the dentist, who was able to overcome in great measure the previous lack of occlusion.

The final report illustrates a suggested scientific approach and treatment of a case previously treated with restorations and which showed not only a lack of diagnosis, but also failure to give any thought to functional treatment.

The case is a major one, a maxillary retraction and mandibular attraction.

Case 5.—A woman, aged 40, had a facial disfigurement so pronounced that it was difficult to prevail on her to be photo-

graphed with the bite in the natural position. (Fig. 17.) The mouth had been restored with nonfunctioning cantilever bridges. (Fig. 18.) The maxillary lateral incisors were congenitally missing. Figure 19 is a roentgenographic study of the case.

The therapy employed consisted of removal of all bridges. The abutment teeth had the usual lack of preparation and therefore needed no immediate attention. An appliance consisted of bands placed on the maxillary first molars, with 0.040 round buccal tubes attached. The maxillary cuspids and central incisors were banded with bracket bands and biteplanes soldered to the lingual surface of the central bands. (Figs. 20-21.)

The patient was instructed to bite lingually from the central incisors and keep the mouth open slightly during the whole of the treatment period. Retaining appliances in the form of partial dentures were made to act until the dentist had sufficient time to complete the permanent restorations.

Figure 22 shows the gnathostatic denture reproduction and photostatic facial reproduction of the completed case. Figure 23 shows intra-oral photographs of the completed case. Figure 24 is a roentgenographic study of the case after treatment.

Fig. 24.—Roentgenographic study after orthodontic therapy.

CONCLUSION

Although it is our duty to equip ourselves with the knowledge and skill required to recognize and correct adult dentofacial deformities, it is of greater importance not only to learn to recognize the early signs of impending dental deformities in childhood, but also to do all in our power to aid and further the cause of prevention.

THE FIRST PERMANENT MOLAR*

By WALTER C. McBRIDE, D.D.S., F.A.C.D., Detroit, Mich.

KENNETH EASLICK, director of the children's department of the University of Michigan College of Dental Surgery, in a moment of irritation, I think, over a prolonged sentimental discussion of the importance of the first permanent molar, remarked, "Placing the first permanent molar on a fine white pedestal of gleaming tooth consciousness defeats a good many purposes of children's dentistry by misplaced emphasis. The first permanent molar is not the only permanent tooth, nor the only important tooth. The deciduous teeth are exceedingly important to my mind, and we have also other permanent teeth in the nature of molars and bicuspids, and plenty of anterior teeth—a few of them fractured."

On the other hand, the first permanent molar, erupting posteriorly to the deciduous teeth, with no displacement, and erupting in most instances without the knowledge of the mother or child, is the least considered tooth of all, as far as the laity is concerned. Much has been written to convey to parents the importance and a knowledge of the function of this tooth, but its identity has not as yet been sufficiently established. Consequently, it is, in many cases, sadly neglected.

I have seen mothers become indignant on being shown or informed that the tooth in question is a permanent tooth—the first permanent molar. I have been told in quite decided terms that I was wrong—they knew positively that my statement was not true. Some of the indignation is due to a reluctance to admit error, but most is due to keen disappointment incident to realization of neglect, even though unintentional. The radio, public school lectures, parent-teacher lectures, school examinations, by dentists and school nurses; newspaper editorials, and public health pamphlets will, in time, so disseminate knowledge of the identity and importance of this tooth that even the most ignorant will understand.

Any measure or presentation, conscripted or devised, that will answer the two following questions, asked by parents many times daily in an office devoted to children, is worthy of consideration:

1. Why should my child have cavities in those new teeth—they have just come in—when I have fed him vegetables and fruits and given him cod liver oil regularly?

2. Do my teeth decay from the inside? My dentist finds so many cavities in my teeth that I am not conscious of having—they never ache—and when he gets through the enamel, the whole inside of the tooth seems decayed.

With the use of the Bödecker charts, which I have mounted in a leather fold-over, a fine No. 2 Hyatt explorer and a model showing an amalgam filling in the fissure of a lower first permanent molar, I attempt to answer the questions in lay language.

*Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

GROWTH AND DEVELOPMENT

The centers of calcification of the first permanent molars appear at the age of 2 months, and the individual cusps are beginning to fuse at from 6 to 7 months. This is contrary to the erstwhile idea that calcification began one month prior to birth and fusion of the cusps was occurring at the time of birth. The recent work of Kronfeld, which has been corroborated by others, gives the ages of beginning calcification and fusion of the cusps as mentioned above. To quote:

> At the age of two months, there are from three to five separate small centers of calcification, the largest of which is the one in the buccomesial cusp. . . . After about 6 months of age, the individual centers of calcification have become so wide at the base that they are united. This union first takes place along the marginal ridges of the occlusal surface, so that the calcified portion of the crown forms a ring with a center (area of the future central fossa) still uncalcified. Then the distobuccal and the mesiolingual cusps of the upper first permanent molar are fused by a ridge of enamel and dentin running across the occlusal surface and corresponding to the future oblique ridge. At 2 years, the process of enamel formation has reached the cemento-enamel junction, and at 3 to 3½ years the crown is fully formed and the root beginning to develop.
>
> From apparent data, one may draw the practical conclusion that the enamel of the first permanent molars has reached its final and permanent condition at the age of from 3 to 4 years. After this time, it can no longer be influenced by disease, nor is it accessible to medication or other influences. If it is normally formed and calcified at 3 years, it will be so when the tooth erupts three or four years later. If it is poorly formed and imperfectly calcified, this will be its condition at the time of eruption.

From clinical observation, the age of eruption has little variance. In unusually precocious children, this tooth may appear at 5 or 5½ years, and, in tardy development, it may erupt at 7½ years, but, generally speaking, the variance from 6 years of age is very slight. Perhaps the fact that its eruption is not influenced by the presence of a predecessor has much to do with its regularity. The same is relatively true of the second permanent molar. The third molar, because of its tendency to anomalous formation, and because of the great possibility of impaction in the present comparatively diminutive development of the jaw of man, is far from regular in its eruption. An authentic instance has been reported wherein third permanent molars erupted at 65 years of age, fifteen years after the insertion of full dentures.

The first and most common evidence of a pathologic condition in the newly erupted first permanent molar is the failure of fusion in the occlusal surface and in the buccal pits. There seems to be some little discussion among writers as to whether this failure of fusion of the cusps is pathologic or normal. Bödecker states, "Fissures are so frequent in the occlusal surfaces of molars that they may well be regarded as a common occurrence —yes, even a normal condition." Kronfeld says, "A molar with its typical and characteristic fissures is a normal molar. A molar without fissures would be just as defective or abnormal as a molar without cusps or without a pulp chamber." He wishes to modify Bödecker's statement as follows: "Fissures are always found in the occlusal surfaces of normal human and many other mammalian molars. They are, therefore, a normal condition." Hyatt, discussing the condition, designates it as "morphological imperfections called pits and fissures."

The normality or abnormality of these fissures does not modify the fact that they are very commonly existent. Students of anthropology and paleontology

bear testimony to the fact that fissures—apparent defects—always have been present in the bicuspids and molars of human beings. I venture the opinion that possibly the weaning period, with the attending possibility of calcium deficiency in the new dietary, or with possible lack of calcium while becoming acclimated to a new dietary, at from 7 to 9 months, simultaneously with the fusion of the cusps of the first permanent molar, might be a factor in this condition. With the present modified artificial feeding, from birth, of the new generation, this, of course, would be irrelevant. The prevalence of this condition in children who have been breast-fed or the nonprevalence in those who have been artificially fed from birth, has never, to my knowledge, been observed. It would be an interesting experiment to observe a large number of such cases in an attempt to justify this possibility.

The prevalence of the "failure-of-fusion" areas, or fissure defects, is borne out in a survey made by the Hyatt Study Club, which gave the startling information that only one permanent molar in 2,200 survives the age of 12 years without requiring a filling. In other words, only one child in 550 could be safely excused from the necessity of filling the fissures in the first permanent molars prior to 12 years of age. Not from statistical data, but from clinical observation in my own practice and in the children's division at the University of Detroit, it would seem that the percentages as given might be accepted as very patent and average, if not liberal.

The care or treatment of these areas has been defined in a new term, "prophylactic odontotomy," coined by the Hyatt Study Club. The introductory sentences of the volume of the same name, published by the Hyatt Study Club, are as follows:

> Prophylactic Odontotomy, as the term implies, consists of the removal by cutting of a defective part of a tooth in order that the area so treated may be protected from a threatened onset of caries. The operation is confined to those morphological imperfections called pits and fissures. . . . For all practical purposes a pit or fissure is an opening in the enamel into which the point of the explorer will sink below the surface at the point of entrance, and cling between its narrow walls.

It might be well to mention the necessity of using fine sharp explorers in examining the surfaces of the tooth in order that there may be some agreement as to when an explorer will sink below the surface at the point of entrance and cling between its narrow walls. I have observed in many offices, as well as in the student clinic, that explorers are being used which are not in good condition. Many bear evidence in their brevity and bluntness of being used for many purposes other than the detection of enamel defects. Hyatt's set of four explorers, and in particular the No. 2, is very practical for use with juvenile patients.

To attest to the necessity for filling teeth with enamel defects, I quote again the result of one of the Hyatt Study Club surveys:

> The absolute necessity of caring for these tiny precarious openings in the enamel covering of the teeth of children is well illustrated by a study made in 1928 with a group of 150 school children. On a reexamination made nine months after the first one, it was found that out of 616 precarious fissures, there were developed 568 carious cavities. Another way of stating this would be that 92.2 per cent of the fissures had become carious cavities in nine months' time. This study, though of so few children, can be taken as a fair sampling of conditions common to juvenile patients. Even a casual study of these precarious areas in cross-section, and of the statistical data common to this tooth, must conclusively establish at least three points:

(1) The PRESENCE of caries at the bottom of a pit or fissure cavity is not always or often observable externally.

(2) The DEGREE of caries present at the base of a pit or fissure cavity cannot be definitely determined from external observation.

(3) The PROGRESS of caries in occlusal pit or fissure cavities, because of its unobservable location, cannot be positively predicted by external observations, no matter how frequently such examinations may be made.

Obviously, therefore, it is incompatible with the purposes of operative preventive dentistry to attempt to keep a certain pit or fissure under observation and only operate on it when it shows outward signs of caries, for, by the time that there is external indication of the presence of caries, extensive tooth destruction has already taken place.

In the examination of thousands of different persons, and tens of thousands of teeth, this one fact is so forcibly and repeatedly demonstrated as to be acceptable as axiomatic: THE ENAMEL DEFECT OF TODAY IS THE CARIOUS CAVITY OF TOMORROW.

SILVER NITRATE PRECIPITATION IN FISSURES

As a simple expedient in the treatment of precarious fissures, certain dentists have advocated, as a preventive procedure, the precipitation of silver nitrate. The tooth is isolated and the occlusal portion covered with a thin coating of varnish. When this is allowed to dry or set, a heated explorer point is drawn throughout all the grooves. Silver nitrate is then precipitated into the accessible fissures. It can be done also by isolating the tooth and applying the solution without employing the varnish.

In precipitating silver nitrate, an ammoniacal solution is used preferably; or a 40 per cent freshly prepared solution will suffice, being carried to the clean, dry surface of the tooth with an applicator and worked into the fissure with the to-and-fro motion of a sharp explorer. The silver will be precipitated from the solution by applying a cotton pellet saturated with eugenol and allowing it to remain for a few minutes. This may be repeated, if desired. Some advocate the use of developing solution for precipitation; others, formalin, which gives considerable discomfort if there is contact with the mucous membrane. After the excess solution has been removed with cotton pellets, the surfaces are flushed well with warm water to eliminate the possibility of mucous membrane irritation. In precipitating silver nitrate, it is a rather good plan always to have a salt solution available to counteract the action of silver nitrate should it come in contact with the soft tissue of the mouth.

In either case, the effect desired is that the finely divided silver shall occlude the fissure openings, incipient caries thus being prevented. It seems questionable whether this effect is beneficial or detrimental. It is my opinion that the precipitation of silver is not alone sufficient to inhibit incipient caries in occluded areas, and, once it is precipitated, the resultant discoloration obscures all natural evidence of active caries and disintegration.

FISSURE OPENING AND FILLING

Silver nitrate precipitation in the fissures of molars may serve commendably in the hands of certain operators. Similarly, forcing cement into the fissures may be beneficial in the hands of others. An inefficient operative technic and lack of periodic observation in both instances will entail failure. Opening the deep and defective fissures with burs and filling with some suitable filling material will prove effective in the hands of all.

The technic for the preparation of precarious fissures is a simple procedure. Primarily, it is more or less accepted as a

rule that, in precarious fissures, the cavity should extend the full length of the central groove and include the mesial and distal pits. First, the fissure is opened throughout with a No. 33½ inverted cone bur, being extended to firm enamel and the cavity defined. Frequently, it will be necessary to follow with a larger inverted cone bur (No. 34), especially in the mesial and distal pits. Next, a No. 557 cross-cut fissure bur is employed. Ordinarily, this bur will complete the preparation, sufficiently sharpening the angles, flattening the floor and paralleling the walls so that further retention is unnecessary. If more retention is desired, one may accentuate the line and point angles with a No. 34 inverted cone bur. Certain operators prefer a No. ½ or 1 round bur. As a rule, undercutting is neither necessary nor desirable. Should the defect penetrate into the dentin in the central pit or elsewhere, a small round bur, No. ½, 1 or 2, is used to remove the decalcified portion. No attempt should be made to level the occlusal floor of the cavity to the depth of the pit.

The greatest tendency to err in this preparation is in not sufficiently seating the cavity in the mesial or distal portion, particularly the mesial. Too frequently, the enamel fusing rather firmly in this area, the cavity is not seated deeply enough and the filling fractures from lack of bulk. The fissure should be opened and the cavity seated at the dentino-enamel junction. Another possibility of error is in not sufficiently widening the cavity. It appears to me quite impossible to satisfactorily condense amalgam in any cavity smaller than one made with a No. 557 cross-cut bur. No. 700 and 701 tapering cross-cut fissure burs are not sufficient. To that end, the smallest plugger in my set of plastic instruments is made of such diametric dimension that it will just fit into a cavity of No. 557 bur size.

The instrumentation may vary with each operator, but the foregoing is a simple expedient, found practical and sufficient. The choice of burs is dependent, to a great extent, on the hardness of the enamel and the continuity, or lack of continuity, of the divergent fissures.

If the enamel is penetrated and caries is present, the cavity must be extended to completion; in which instance, the selection of any suitable larger cross-cut fissure burs for extension is acceptable. Where considerable caries is evident in the beginning, I proceed to extend the fissure with a No. 702 tapering fissure bur. Next, suitable chisels are used to gain the outline form and plane the enamel wall. In removing the caries, it is wise to use the largest round bur accessible to carious portions of the cavity, whether it be No. 1, 2, 3, 4 or 8, the next smaller size (round bur) being used finally, to complete the periphery of the carious area. The floor is flattened and the walls paralleled with a No. 558 or 559 cross-cut fissure bur. At times, the final portion of the fissure extension is made with a No. 557 or 701 cross-cut fissure bur.

IMMUNIZATION

If the pit or fissure does not penetrate the enamel, immunization may be effected. This is recommended quite generally by some operators. I have encountered only a few cases where it seemed practical, instances in which the enamel on the converging cusps had a white chalky appearance and the contour was such that there was a decided elevation just before the converging walls suddenly terminated in a precipitous crevice.

Like the term, "prophylactic odontotomy," "immunization" was brought into dental terminology by the Hyatt Study Club. Their version of "immunization" is as follows:

THE OPERATION OF IMMUNIZATION: In a few cases where the pit or fissure apparently does not involve the entire thickness of enamel, immunization may be resorted to.

The pit or fissure is entered with a No. ½ round bur. If the bur enters through to the dentin, the cavity is prepared for filling. If the dentin is not reached, immunization is accomplished by following the No. ½ round bur with first a No. 1, then a No. 2, and finally a No. 3 round bur, if necessary, being careful not to penetrate deeper through the enamel, but gradually to enlarge the orifice of the pit or fissure and transform it into a shallow fossa or groove with rounded bottom, which is thus made continuous with the surface on which it is located. This fossa or groove should now be gone over with a small stone, and finally with pumice and a wood point, to give it a smoother finish, in which food débris will no longer be likely to be retained.

PULP CAPPING

Exposures, and near exposures, of instrumental origin present quite a favorable prognosis for pulp capping. Quite the contrary may be expected if exposure is the result of caries. Owing to the greater vascularity of the pulp in newly erupted permanent molars, successful pulp capping is more common in younger children. An exposure in a permanent molar of a child, aged 7 or 8 years, seems to respond much more favorably, and in greater percentages, than in a child aged from 10 to 12 years. It is very evident clinically that pulp capping in the young permanent molar is much more successful than in the deciduous molars.

Successful pulp capping requires great care in instrumentation. All the caries should be removed. The tooth should be isolated, treated with phenol, followed by alcohol, and dried with warm air. Hemorrhage must be completely controlled before applying the capping. If the exposed area is not too large, thymolized calcium phosphate, mixed to a paste with eugenol, can be used. This preparation has enjoyed a much greater use than any other material. Zinc oxide and eugenol is used extensively also. After the pulp-capping has been applied, a thin mix of cement is permitted to flow over it and allowed to harden, and, in turn, the filling material is placed. In instances of extensive exposure, metal disks especially designed and manufactured, or cut from gold plate by the operator, are advocated by some. These are contoured with a raised central portion into which the pulp-capping mixture is inserted, and are then placed over the exposed area. Cement is then allowed to flow over the metal, and the filling placed as above.

PULPOTOMY (PARTIAL PULP REMOVAL)

In exposures of instrumental origin, or when there is no exposure, but the carious dentin is such that complete removal of it would result in an exposure, and in cases wherein the retention of infected dentin would result in future self-devitalization, the practice of the removal of the coronal portion of the pulp (pulpotomy) has had favorable results in the hands of many operators. This is advocated particularly for children prior to complete apical formation of the permanent molar roots. Where this procedure can be effected, and, at the same time, the apical formation of the tooth proceed, a long step has been taken in the conservation of dental structure. When apical formation is complete, the relative success of such treatment is reduced. Further, when apical formation is completed, one can resort to complete pulp removal if necessary.

In a pulpotomy, if nitrous oxide, conduction or pressure anesthesia is used, the operation can be completed at a single appointment. If desensitizing pastes are

used, a second appointment is required. In these cases, the field must be well isolated with cotton rolls or rubber dam, the latter being preferable, although difficult of manipulation in young children, and the field sterilized with iodine and alcohol. Access is had to the pulp chamber by the use of excavators or cross-cut fissure burs and, with a large round bur or round surgical bur, the coronal portion of the pulp is removed. The pulp can be removed by the bur, one rotary movement in the pulp chamber excising it at the opening of the root canals. The hemorrhage can be controlled by the application of phenol or formocresol, or other styptic agents, on cotton pellets, which must be used repeatedly and with considerable patience. Cautery with a blunt instrument is used frequently and effectively in the anterior teeth, but has the disadvantage of inaccessibility in many cases in the molar region.

Hydrogen peroxide, applied after the styptic agent or cautery, has an excellent sterilizing effect and, in the effervescing action, removes the débris from the cavity. The cavity is then dried by means of alcohol and warm air, and a thin mix of either sealer powder and glycero-iodine solution, or thymolized calcium phosphate, is allowed to flow over the exposed pulp ends. If the compound is used, a thin mix of crown and bridge cement may be allowed to flow over it at once; if thymolized calcium phosphate is employed, one must wait a few minutes until the material has set. The metal restoration may be made at once.

This technic is very simple in the anterior portion of the mouth, being particularly adaptable to fractured central and lateral incisors.

PULPECTOMY (COMPLETE PULP REMOVAL)

Carious self-devitalized posterior teeth becoming pulpless prior to apical formation, according to roentgenographic evidence, should be extracted. It is true that in many cases of abscess and putrescence, occurring prior to apical formation, the teeth may be relieved of soreness, sterilized and comfortably maintained for a short time, but one cannot feel secure in stipulating any length of service whatever. With this thought, it is prudent to extract at once, the earlier the better, thus permitting the second molar to drift forward in eruption, and assume, or partly assume, its place. It is amazing how by mesial drifting, the second permanent molar will approximate in position the normal position of the first permanent molar if the latter is removed at an early age. I am, of course, not unaware of the orthodontic problem created by early extraction. On the other hand, the retention of pulpless and infected teeth is not a healthy condition for a growing child. One's policy of extraction, generally, is modified by the condition of the deciduous molars, if present, and also by their absence, but, in the instance of permanent disability, extraction is unquestionably indicated.

If devitalization occurs subsequent to apical formation, the root-canal procedure common to any permanent tooth may be employed. At its best, root-canal work in either upper or lower first molars in children is a difficult task because of the size of the oral cavity. After the second and third permanent molars are in place, with the accompanying forward growth of the maxillae and mandible, the oral cavity is considerably larger and the molar in question much less distant, comparatively, from the front of the mouth. Thus, the molars are much more accessible.

There is no apparent need for rehearsing here the root-canal technic for permanent molars. This is thoroughly discussed and outlined in general operative

dentistry. I wish to add that I have not used guttapercha points in the permanent molar canals in a number of years, using only the sealer powder and glycero-iodine solution, pumping it into the canals as in the deciduous teeth and forcing it to the apices with a heavy cement base. The inaccessibility of these teeth, in young children, together with the accompanying inadaptability of guttapercha points to the mesial root, has led to this method of treatment. The apparent results compare favorably with those attending the use of guttapercha points.

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DISCUSSION

Konrad Lux, Waco, Texas: Dr. McBride has probed into the inner consciousness of so many first permanent molars that he has become a storehouse of wisdom and knowledge. The first permanent molar presents an age-old problem. I fear it will remain a problem until more teaching and preaching have been done. I agree with Dr. McBride, as I am sure all of you do, regarding the positive parent and the first permanent molar. *We* are aware of the importance of the first permanent molar, but the majority of parents are not, and I believe that many of the dentists are to blame for this situation. Some dentists do not find cavities or imperfections in these teeth, owing to careless examination or failure to use fine, sharp explorers. Or, if they find them, they say, "I will fill that tooth later." Procrastination has caused more grief and failure than almost any human error. This we find every day in the teeth we see, and it is true in our work and in our lives. The dentist with the poorly selected or dull explorer cannot find cavities. The dentist with the proper explorer often finds cavities in the teeth of the patient who has been examined by the negligent dentist, and this makes the competent dentist appear unscrupulous, or he is considered an alarmist. The two questions propounded by Dr. McBride make us feel that we are back home in our own daily office routine. "Why does my child have cavities in new teeth when I have given him every attention?" And "Why do I have cavities when there is no pain?" If we can answer these questions intelligently, we will make great strides in educating parents and patients. I see a need for the general practioner to take more time to properly enlighten parents. It is the dentist's responsibility to eradicate from the minds of the parents the fact that decay in teeth is not always the result of neglect. Decay can be caused by congenital malformation. A large majority of intelligent parents are not conscious of this fact. Once we enlighten them on many such important phases of our work, we have broken down a barrier that has long handicapped our profession. Rare is the person who can place himself in the other person's position. Just because we know the importance of these first permanent teeth, as well as all teeth, and the need of regular observance and attention, we have a tendency to leave it entirely to the parent to ask for our services. The conscientious physician does not hesitate to say, "Has your child had a Schick test this year?" This is not unethical —it is his duty. We should say, "Your child's teeth need regular attention after the first tooth is present." While we are on the subject of questions asked by patients, I should like more information on the erupting of decidous teeth, the loss of these teeth and the erupting of permanent teeth. My observation has been that the teeth that erupt early are lost early, and subsequently the eruption of the permanent teeth occurs early. Some dentists disagree. This question is frequently asked by parents and should be answered intelligently for psychologic reasons if for no other. I do not advocate or practice using silver nitrate precipitation for the treatment of deep fissures. After finding the number of cavities developed from these precarious openings in the enamel covering of the teeth and being urged onward by the reports of Dr. McBride in the observation of 150 school children that 92 per cent, or 568 of 616 precarious fissures became carious cavities in nine months' time, I do not think it ad-

visable. For just that reason, I find it much more satisfactory to the patient and more satisfying to treat these precarious fissures, when found, by prophylactic odontotomy or by fillings, whichever is indicated. Experience has taught me that pulp capping is much more easily accomplished in younger patients. Quite often, many of these teeth do not survive capping. The pulp becomes putrescent, and an abscess is formed and it is necessary for the tooth to be extracted. I do not believe pulpectomy should be practiced unless it is necessary to retain the tooth for further development. Pulpectomy should be advised only when we are assured that frequent checkups can be had by roentgenograms. Walter Pitkin, a brilliant, present-day author, tells us in his book, "New Careers For Youth," how little is spent on dentistry every year, and how much is spent on cosmetics, cigarets, etc., simply because the public is not interested in dentistry. He gives statistics on this, and the data are appalling. It seems to me that it is our duty to arouse the public interest in dentistry, and I believe that we can find a way. Dr. Pitkin even advises the youth of today not to take up the practice of dentistry unless he has made up his mind that he could not be happy unless he did, simply because he does not predict a very bright future for the profession unless the public is inspired to the dire need, joy and beauty of dentistry. Comparatively few people realize to the fullest extent the contributing rôle that teeth play in their health, to say nothing of their looks. Let us set our goal to improve this condition before we meet next year and do some creative thinking, discussing and planning, for, I firmly believe, results will follow. Further research should be made and statistics arrived at on this important subject, the first permanent molar, the defective or decalcified pits being observed over a period of time in a number of states and a report of these results being generally made known, and forcibly enough to shock the American public. Only when children are examined and reexamined from time to time and from year to year in large groups can we expect to accumulate data giving us authentic information by which we can work, and, in turn, be in a position to enlighten the parents. Medical science spares no time, study or expense in definite research to obtain even the smallest degree of information concerning the human body. It is, then, the responsibility of a group such as this to make up our minds to accomplish the things that we know should be done to keep up the standards of the profession.

SURGERY FOR THE DENTURE PATIENT*

By O. T. DEAN, D.D.S., Seattle, Wash.

SURGERY for the denture patient comprises not only the removal of all remaining teeth and roots and elimination of areas of infection, including cysts, but also the paralleling of the sides and the elimination of all bone and soft tissue excess and irregularities. Cleft palate in the prospective denture patient is neglected by the majority of the medical and dental professions because they believe these cases are inoperable. My experience in operating on clefts of the palate is that age is no barrier to the successful surgical closure of the cleft and that the soft tissue only in the median line of the palate is an aid rather than a detriment in retaining the denture.

The teeth to be removed should be

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charted and all abnormalities recorded before consideration of the anesthetic, which should be the one that will assure the most nearly perfect result with the least discomfort and greatest safety to the patient, and under which the individual operator can do his best work.

The mouth is prepared according to the technic chosen. The arches are reduced and the sides paralleled to the best possible degree with the tissue present. To prepare the bone and soft tissue is not so easy as to plane and finish a board of mahogany, nor do they remain as they are finished. Bone does not absorb with the same rapidity and evenness. Therefore, about the fourth week after extraction, the ridges reach their most irregular state, and from the third to the sixth week is not the time to place dentures. By the end of ninety days, most of the small irregularities are absorbed and the sockets filled with soft tissue and new bone. It takes six months or more for bone to become firm, normal alveolar osseous tissue. We cannot preserve the framework of the alveolar ridge and cut it off at the same time. The greater the amount of tissue removed at the time of operation, the smoother the ridge will be at the time and the fewer irregularities there will be during the time of absorption and shrinking of the process. The less there is removed at the time of operation, the better the framework of bone; which affords an opportunity for regeneration and filling the sockets with new bone, a full, dense, round ridge resulting.

There are three methods of mouth preparation: (1) permitting time for absorption and a minimum of surgery; (2) alveolectomy, and (3) intraseptal alveolotomy.

The first method, permitting time for absorption, does not prepare the mouth for immediate dentures and requires from four to six months for the sockets to fill in with bone and the high and irregular alveolar process to absorb and become smooth. Almost every case requires more or less of surgical measures to remove minor irregularities. This method will assure a higher percentage of perfect ridges, which will give the greatest number of years of denture service and conserves the osseous tissue to the maximum degree.

The second method, alveolectomy, prepares the mouth so that immediate dentures are possible. In brief, the technic involves elevating the mucoperiosteum and shortening the palatal plate and septal bone, and removing the labial and buccal bone to a greater or less degree to reduce the excess tissue and undercuts; completing the bone preparation as desired and eliminating the areas of infected tissue—cleaning and suturing.

The third method, intraseptal alveolotomy, also prepares the mouth for immediate dentures. It is a technic to reduce the labial and buccal prominence of the process without removing the cortical plate of bone. This is accomplished by cutting a small inverted V in the intraseptal bone, then completing the work with a chisel through the plate near the apex of the sockets, producing a fracture. The irregular bone is smoothed below the free labial or buccal plate of bone by use of a file and the sockets are freed of infection and irrigated with warm antiseptic solution. Reduction is accomplished by molding the walls together with the fingers and suturing to hold in position.

I recommend in preference to alveolectomy this procedure of removing of the external plate of bone. This technic, which is my original contribution to the profession, was developed in 1916-1917. Having devised this operation to conserve the external labial and buccal plates of bone without disturbing the periosteum,

I sincerely believe that, if correctly carried out, it is much more likely to produce a good ridge than is any other operation.

The temporary denture is a factor in preventing the development of a good ridge. The suction produced in the open sockets by intermittent pressure of the dentures retards ossification of the sockets, which fill with fibrous tissue instead of new bone. The framework on which to build new bone is the septum, the thin labial, buccal and palatal process. When the sockets are filled with soft fibrous tissue only, and this bone is absorbed, a soft fibrous ridge remains; as in the case of a fractured mandible that has not been stabilized, a fibrous union resulting. Intraseptal alveolotomy practically eliminates this condition. I cut out a small part of the intraseptal bone and complete the work with a chisel, producing a fracture, then collapse the cortical labial and buccal plates of bone toward the palatal aspect and, to a great extent, eliminate the socket at the time of operation. The two raw bony surfaces are thus brought together and the bone regenerates more rapidly and more thoroughly than it does in the open socket.

Removal of a large or small cyst is easy to visualize and enucleation is not difficult when intraseptal alveolotomy is employed. This method of approach to the cystic area conserves the small or large islands of labial, buccal and palatal bone; which hastens bone regeneration in the cyst area. One other outstanding feature of this technic is the fact that the normal labiobuccal fulness of the ridge is maintained.

Grafting of bone to build up areas of lost osseous ridge has not been developed to its fullest extent. Much valuable bone has been sacrificed by chisel or rongeur, or when a section of the labial or buccal bone has been dislodged by the removal of the teeth. A piece of the plate that is detached or removed with the teeth should be placed in physiologic sodium chloride solution until the grafting is completed. Just before suturing, the segment is placed in the same area or in any other surface in the ridge where wanted. The mucoperiosteum in contact with the periosteal side of the bone graft is carefully massaged, then sutured securely as in fixation of a fracture.

To restore an area of excessive loss, a segment of bone is transferred to the place desired and secured by suture.

In performing minor bone grafting in the ridge, I have had almost 100 per cent perfect results in retention of the graft.

Preoperative or normal bone irregularities are varied and should receive attention at the time of extraction and mouth preparation. A torus palatinus, large tuberosity and heavy, dense buccal ridge are most common types of bone excess on the upper arch.

The lower jaw has an excess internal oblique ridge extending inward on the lingual side of the mandible on one or both sides and, at times, assuming shelf-like proportions. A tubercle of bone on the lingual side of the lower bicuspid may be a rounded eminence or may be nob-like. In many of these cases, it extends on the lingual side of the mandible from bicuspid to bicuspid, forming a hard, dense ridge.

Time permits only the suggestion of a technic that is applicable to all of these areas. The incision is long and through the mucoperiosteum, which should be well elevated from the bone to give visibility and accessibility. The bone excess is removed with a chisel the bevel of which is toward the body of the bone. The bone surface is completed with a file or scraped smooth and the mucoperiosteum is sutured back into normal position.

The large, soft-tissue tuberosities are removed by incision first on the buccal aspect about 1 or 2 mm. below the epithelial surface and pared toward the palate well over the crest of the ridge.

The second incision is made parallel to the first, deeply and in contact with the bone and joining the first on the palatal side to make a wedge-shaped piece, which is to be removed. The tissue is secured with a suture.

Acquired soft tissue excess is caused by wearing ill-fitting dentures. A wide variety of cases are seen. These are corrected by excision or dissection, as determined by the case in hand.

Acquired bone irregularities are caused by poor denture construction and the presence of a hard bony area on the crest of the ridge that does not absorb evenly. In the first place, the impression is not treated to eliminate the elevations left by the sockets of the teeth. Secondly, the model over which the denture is to be cast is not made smooth and round and thus the ridges are not ultimately as you wish them to be when they have completed shrinking.

It is not possible for the ridge to be filled in and rounded out when the patient is wearing dentures that have irregular nodules where the sockets of the teeth were and square edges in the denture that exert undue pressure at a given point.

Even if the denture is fairly smooth and is not checked up and is permitted to cause stress on the crest of the ridge, the result will be an irregular and sore denture foundation. The ridge will roll outward in most cases and at times inward. Beneath will be very thin tough bone scales much like handsaw teeth. To correct this malformation of the ridge, the best treatment is surgical. An incision is made along the buccal aspect, near the crest, where the mucoperiosteum shows the fold. This incision is made to the bone, and the soft tissues are elevated from the crest on both sides. With a chisel and rongeur, the bony edges are removed and the ridge is filed smooth. Then, with the scissors, the thick, flabby soft tissue excess is trimmed from the mucosa on the lingual flap, the margin being cut to be as even and smooth as possible. Horsehair or other suture material is used to make a perfect adaptation of the two margins of soft tissue.

CLEFT OF THE HARD AND SOFT PALATE

My observation and experience in cleft palate surgery leads me to believe that there has been much negligence in closing of the tissue of the palate in adults. Age is no barrier to the successful closing of the palate and reproduction of the soft tissue to assure closure of the nasopharyngeal passage after speaking, drinking, and eating.

The tongue pressure is the greatest of all causes of the nonunion and slough following surgical adaptation of the palatal tissues. During the past eighteen years, I have developed and used a guard which prevents all tongue pressure and simplifies cleft palate surgery to a great extent.

My surgical technic is practically the same as that of others, but my method of suturing differs.

A mattress stay suture of silkworm gut is followed by catgut mattress sutures nearer the margin of the tissue, after which horsehair adaptation sutures are used.

Patients that I have operated on have ranged from 28 months to 56 years in age, and in none of these cases have I encountered sloughing or pulling of the sutures.

The making of this guard is very simple. It is now made with orthodontic band material and constructed with

technical wire adapted to meet the requirements of the case. It is made and fitted previous to operative procedure.

Reproduction of the soft palate makes it possible for the patient to close the nasopharynx and cast aside the cumbersome mechanical device, the obturator, which is used for this purpose.

SUMMARY AND CONCLUSIONS

1. Surgical measures for the denture case should produce a smooth, full, round ridge with sides nearly equal and parallel.

2. If time is allowed for rebuilding bone in the sockets before the denture is made, the percentage of good denture ridges will be higher.

3. The technic chosen should be that which will assure the patient the best results.

4. Intraseptal alveolotomy is superior to other methods if the operator is trained in the technic to make the most of its advantages.

5. Conservation of the thin bony shell of the cyst will preserve the denture foundation.

6. A bone graft to build up the ridge offers a field for much constructive work.

7. Bone and soft tissue irregularities, present and acquired, should receive attention, to assure better denture foundations.

8. Attention to impression and model treatment is necessary to assure a serviceable denture and prevent irregularities.

9. In all cases of cleft of the palate, the patient can be operated on successfully, at any age, and can wear dentures with as much comfort and efficiency as can other denture patients.

In one case, an operation was performed to correct a cleft palate in 1919, at the age of about 28 years, at which time the patient had her first denture. This denture is very serviceable after seventeen years' use.

A SIMPLE RATIONAL ROOT-CANAL THERAPY EMPLOYED IN CONJUNCTION WITH APICAL RESECTION AND CURETTAGE

By MAXWELL B. COLTON, D.D.S., New York City

THE usual procedure in cases requiring root-canal therapy, apical resection and curettage is to fill the root canal before performing apicoectomy. This sequence is, in my opinion, contrary to good surgical practice. No matter what method is used to sterilize the canal before filling, there is no positive assurance that bacterial seepage will not take place immediately prior to the placing of the filling material. The abscess acts as a periapical reservoir of reinfection.

It may be asserted that electrolytic medication offers a means of sterilizing the abscess itself, thus eliminating possible reinfection of the canal. There is no positive means of determining the sterility of the abscess area before filling.

I have employed a simple method that assures complete and positive elimination of the abscessed area or reservoir of reinfection before filling the root canal. The method permits of completing both the apicoectomy and the root-canal therapy in one or at most two short visits. The canal is opened, cleaned and, if neces-

sary, enlarged mechanically with broaches and files. If desired, a mild medicament such as eugenol may now be sealed in the canal, with a temporary cement made of zinc oxide and eugenol, and the patient dismissed. At the next visit, the temporary filling and dressing are removed.

Fig. 1.—Root canal opened and cleaned.

Fig. 2.—Semilunar incision made to lay back mucosa; opening cut in bone to expose apex and abscess or granuloma.

The surgical area is painted with iodine and infiltrated with procaine. Incision is made and the mucosa laid back. With a surgical bur or ordinary large round bur, a window is cut in the bone, exposing the apex of the root and the abscessed area. With a narrow fissure bur, the affected portion of the root is resected. It is then removed and the entire abscessed area curetted. Sharp edges of the root stump are rounded off with a round bur.

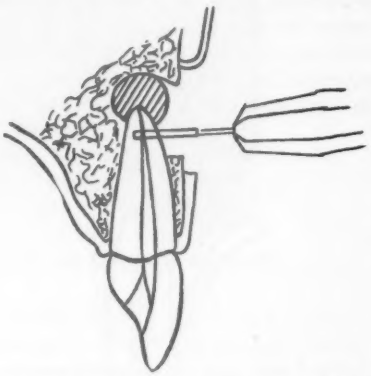

Fig. 3.—Resection and removal of affected portion of root.

Fig. 4.—Preparation for treatment of canal by placing small gauze sponge moistened with alcohol in bone cavity, flooding canal with phenol, neutralized with alcohol, and drying canal with absorbent points.

The bone cavity is swabbed with phenol. and then with alcohol. All possibility of

bacterial seepage from the abscess has now been removed.

STERILIZING AND FILLING THE CANAL

If discoloration is not a factor, as when a porcelain jacket is to follow, the medication of choice is ammoniated silver nitrate reduced with eugenol. Otherwise, according to my practice, a small gauze sponge moistened with alcohol is placed in the bone cavity. With a fine blunt-end syringe, a drop or two of phenol is carefully placed in the pulp chamber. An alcohol sponge is held in readiness to catch any accidental overflow. The phenol is pumped into the canal with a smooth broach, and is then neutralized with alcohol carried to the canal in the same manner. The canal is now dried with absorbent points and is ready for filling. I prefer a paste of zinc oxide and eugenol followed by a guttapercha point.

Fig. 5.—Canal filled and sutures placed.

On removal of the alcohol sponge from the bone cavity (the sponge is originally placed to neutralize any phenol forced into the bone cavity), the guttapercha point may protrude from the root end. This may be removed with a warm burnisher. Any zinc oxide-eugenol paste forced into the bone cavity is removed and the sutures are placed.

Many failures following apicoectomy in the past may be attributed to reinfection of the root-canal filling by bacterial seepage from the periapical area of infection.

The method outlined above affords positive elimination of this condition, and the technic is so simple as to be well within the province of the general practitioner of dentistry.

Figure 1 shows a root canal opened and cleaned mechanically, the armamentarium consisting of burs, broaches and files.

Figure 2 shows a semilunar incision with the mucosa laid back and an opening cut in the bone exposing the apex and the abscess or granuloma. The armamentarium consisted of a surgical scalpel.

Fig. 6 (Case 1).—Left to right: Film taken before treatment, shortly after treatment, six months and three years and five months, respectively, after the second film.

periosteal elevator, tissue retractor, surgical or large round bur and gauze sponges.

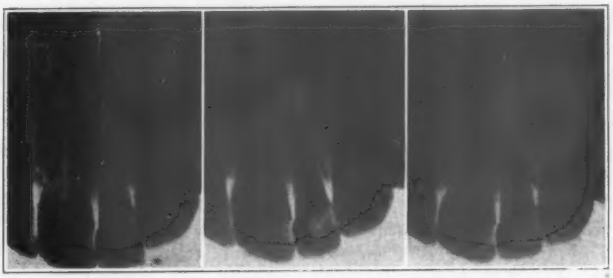

Fig. 7 (Case 2).—Left to right: Film taken before treatment, shortly after treatment and one year and seven and one half months after second film.

Fig. 8 (Case 3).—Films taken before and after treatment, no further check-up being possible.

In Figure 4, a small gauze sponge moistened with alcohol has been placed in a bone cavity. The canal was flooded with a few drops of phenol, an alcohol sponge being held in readiness to catch the overflow. The phenol was neutralized with alcohol and the canal dried with absorbent points. Armamentarium: two glass syringes and two curved blunt end needles (Luer type) made as follows: The temper is removed by heating to a cherry red. The needles are heated in a gas flame and allowed to cool slowly. With needle wire in place, the needle is bent to the desired curve. The

Fig. 9 (Case 4).—Left to right: Film taken before treatment, shortly after treatment and one month and three weeks later (showing definite signs of bone regeneration).

Figure 3 shows the affected portion of the root resected and removed. The area was curetted thoroughly, and phenol and alcohol (to neutralize the phenol) applied. Armamentarium: fissure bur, small and medium size curets.

sharp end is clipped off and the edges are rounded with a rubber disk.

Figure 5 shows a canal filled and

sutures placed. Armamentarium: smooth broach, root-canal pluggers, small curved suture needles, needle holder and silk suture.

Figure 6 shows four roentgenograms from the case of a man, aged 30, in good general health. The first film was taken Dec. 23, 1932; the second, Jan. 20, 1933, after apicoectomy, curettage and root-canal therapy. The third and fourth films were taken July 25, 1933, and June 24, 1936, respectively.

Figure 7 shows three roentgenograms from the case of a man, aged 25, in good health. The first film was taken Nov. 4, 1934; the second, November 9, after apicoectomy, curettage and root-canal therapy. The third was taken June 23, 1936.

Figure 8 shows two roentgenograms from the case of a woman, aged 29, in good health. The first view was taken Sept. 10, 1933, the second, September 31. Further check-up was impossible because the patient left the city.

Figure 9 shows three roentgenograms from the case of a woman, aged 27, who complained of neuralgia of the sacro-iliac region. The first film was taken May 2, 1936; the second May 9, after apicoectomy, curettage and root-canal therapy. The guttapercha points were merely used as plungers to force the zinc oxide-eugenol paste to the root end. The third film, taken June 30, 1936, shows definite signs of bone regeneration. Although all possible foci of infection were to be eliminated, it was decided to attempt to save these teeth because of the restorative problem involved. Other possible foci, such as tonsils and an infected maxillary sinus, have not as yet been eliminated.

17 West Seventy-First Street.

INTERPRETATION OF PAIN ABOUT THE FACE AND JAWS*

By EDWARD REITER, D.M.D., M.S., Cleveland, Ohio

I SHOULD like to discuss certain of the factors in diagnosis of pain about the face and jaws. Primarily, pain is a warning transmitted to the central nervous system that something is jeopardizing the health of a tooth or some other part of the oral cavity. In other words, pain is a symptom of distress due to either disease or trauma. Now when a patient is in distress, our immediate concern is, or should be, the translation of the symptom of pain into terms of diagnostic significance; for it must be remembered that oral disease cannot be treated successfully unless it is correctly diagnosed.

The correct interpretation of pain about the face is not always so simple a procedure as one might surmise. In fact, it can at times be an extremely complex and bewildering problem. Take, for example, the first of a series of puzzling cases that have come to my attention.

A woman complained of pain in a tooth, a "mean" pain, as she said, almost more

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than she could bear. She had had the pain all night long, but suffered in silence for she thought that it might go away by morning. But she still had the pain, and it was worse and she wanted relief. She insisted on the extraction of what she supposed was an aching tooth.

At first glance, the problem in this case does not seem to have been at all complicated, for all but two of the patient's teeth had already been lost. The only teeth remaining in the mouth were the mandibular left cuspid and left lateral incisor; and one of them was thought by the patient to be responsible for her intense pain. The cuspid and the lateral incisor were both pulpless. They showed incomplete root canal fillings, but no evidence of periapical disease in the roentgenogram, which revealed nothing but apparently normal bone tissue cells in the periapical regions. In spite of the negative roentgenographic findings, I removed both teeth. I hastily jumped to the conclusion that the patient's excruciating pain was caused by the two pulpless teeth.

My interpretation of the symptom of pain in this case was of course erroneous, for the extraction of the two pulpless teeth did not free the patient from her distress. Sharp, piercing pains continued to harass her through several more sleepless nights. The pain seemed to originate in the region of the mental foramen and from that point it traveled forward through the lip like an electric shock; or, as the patient frequently described it, "like a red hot needle." There were short periods of remission, but with each new spasm of pain, the muscles of the face contracted in a grimace, which gave to the patient an expression of a most intense suffering.

The sudden onset of lightning, knife-like pains without any apparent cause is typical of trigeminal neuralgia or tic douloureux, yet I mistook the manifestation for a toothache and removed two apparently innocent teeth. The extraction of the two pulpless teeth was of itself not a very serious blunder since they were the only teeth remaining in the patient's mouth. But the humiliating aspect of the mistake was the failure of the extraction to afford the patient any measure of relief.

When pain about the face is vague, or of obscure origin, mistakes in diagnosis are apt to occur with rather disturbing frequency, particularly when other pathologic conditions exist to blur the diagnosis. In illustration of this point, I relate the following experience:

A man, aged 26, complained of pain in a mandibular first molar. His pain was not sharply defined, but was a dull ache, described variously as a "dead" pain, a throbbing and a gnawing sense of fulness. The clinical picture indicated no disease locally. There was no inflammatory process in the region of the suspected tooth, and on examination of the tooth itself, no tenderness to percussion was elicited. Roentgenographically, the tooth did show a large apical pericementoma. This finding immediately established a diagnosis for the dentist, furnishing a specific reason for the patient's distress.

In view of the positive findings, the first molar was removed, but without any beneficial results. The throbbing, gnawing pain that first brought the patient to the dentist continued to cause distress long after the tooth was removed. At first, this was regarded as merely a postextraction pain and treated accordingly. But when the patient failed to respond to the routine postoperative treatment, the condition was diagnosed as dry socket, and more radical treatment was instituted. The mandible was completely anesthetized for the purpose of curetting the socket to remove the decomposed blood clot and all other accumulated débris. When this treatment, like all previous measures, failed to relieve the patient, the socket was flushed with a bland sodium chloride solution and treated with medicaments twice daily. Barbital and all derivatives of the drug were administered freely, but to no avail. The intense pain continued unabated for approximately two weeks.

Two days later, or approximately sixteen days after the onset of the pain, the patient suddenly developed an acute cellulitis. The swelling spread rapidly over the whole left side of the face, extending from the angle of the jaw upward toward the orbit and downward into the cervical region. The patient now had all the manifestations of a violent infection. There was the usual elevation of temperature, with extreme toxicity, and marked trismus, and the intense, boring pain that was present prior to the cellulitis. It was at this point that I first saw the patient.

My first observation of the case led me to believe that I was dealing with only an acute cellulitis. It never occurred to me that the origin of the infection was a point remote from the first molar region. From the history of an infected first molar and its subsequent extraction, I had the impression that the complication was nothing more than an extension of the first molar infection. At any rate, surgical measures were promptly instituted. An extra-oral opening was made at the angle of the jaw to establish and maintain adequate drainage. For two or possibly three days after this operation, there were signs of improvement. The patient became more alert, his temperature was down and he was not quite so toxic as when I first saw him. Improvement was short lived. Two days later, he again became critically ill. The swelling spread all over the face, extending forward this time to the symphysis and also over to the right side of the face. The temperature rose to 103-104 F. and pus flowed in copious quantities from the inside of the mouth as well as from the extra-oral opening. Thorough examination of the mouth intra-orally was extremely difficult owing to the presence of an active inflammation and marked trismus. But I was able to detect, in addition to the free flow of pus from around the teeth, a loosening of all of the teeth on the affected side of the mandible. This was the first indication that I had had of the presence of an osteomyelitis. An extra-oral roentgenographic film confirmed the diagnosis and also disclosed the source of the infection, the third molar region. The presence of a horizontally impacted third molar not only caused this severe infection, but it was primarily responsible for the intense, throbbing pain that originally was ascribed to the first molar region.

During the early period of distress, while all efforts to relieve the patient were concentrated in the treatment of the first molar, the infective process was burrowing its way through the dense compact bone of the third molar region. And when it finally penetrated the outer plate of the mandible and invaded the cellular tissues of the face, destruction of both the soft and the osseous structures became rampant. Most of the cancellous portion of the mandible was destroyed, along with the whole dense outer plate of bone. All of the mandibular teeth became so loose that they were spit out by the patient. Within the short period of ten days, it became necessary to operate extra-orally on four different occasions. The acute symptoms were finally subdued, but pus continued to flow in large quantities over a period of more than eighteen weeks.

This was a most harrowing experience for every one connected with the case. The protracted period of intense suffering prior to the development of the osteomyelitis and the mental anguish over the mutilating operations were almost unbearable.

A correct diagnosis was exceedingly difficult to establish principally because of the misleading nature of the patient's distress. The subjective symptom of pain described by the patient was grossly misleading. Originating in the third molar region, the pain was in some insidious manner referred to the first molar region, where it was related to that tooth by the patient. Then too, the roentgenographic evidence of disease in the first molar region further complicated the problem, helping to obscure the true condition. Too many of us make mistakes of this sort chiefly because we are concerned with the definition of disease. We

have the tendency to emphasize the pathologic conditions of tissues instead of making an exhaustive appraisal of the subjective symptoms.

I recall the experience of one young woman who complained of pain in the upper jaw, described as a sharp, lancinating, diffuse type that traveled to all parts of the face and forehead. The pain originated, the patient thought, in the upper bicuspid region. Examination of this area showed that both bicuspids were pulpless, but they were otherwise negative roentgenographically. In spite of the negative roentgenographic findings, the patient's distress was promptly ascribed to the pulpless teeth. It is needless to state that the removal of the pulpless bicuspids failed to relieve the pain, which, in her case, was found to be due to the presence of a dry, sclerotic, maxillary sinus membrane and not the pulpless condition of the bicuspids.

The symptom of pain in this type of lesion always simulates a "toothache" and invariably leads to the extraction of innocent teeth.

One more example of how deceptive and misleading pain can be, particularly when it is the only guide to a diagnosis:

A middle-aged woman complained of pain in a mandibular first molar, a dull ache that annoyed her most at night after she went to bed. The tooth itself was not tender to percussion and there was nothing in the roentgenogram to indicate the presence of disease other than the encroachment of a large metallic filling on the pulp of the tooth. This gave rise to the suspicion that the patient's distress was due to an irritation of the pulp. The first molar was extracted, but its removal failed to relieve the patient, the pain continuing unabated for more than a week after the tooth was extracted, and, in fact, growing worse with each day. Finally, the patient, in desperation, returned to her dentist and begged to have the second molar removed. She was definitely certain now that her pain was centered in the second molar. When extraction of the second molar failed to free her from her distress, she returned once again for the removal of the third molar. In his desire to relieve the patient, the dentist repeated the mistake a third time.

The pain originated in a deep but obscure cavity in an upper third molar and not in the mandibular molars as the patient believed.

Innocent teeth are frequently extracted because of the misleading and elusive nature of the patient's distress. The pain originates in one part of the mouth and, through direct nervous communication, is often transmitted to a tooth or teeth in some other part or the oral cavity.

An accurate diagnosis is, in many of these cases, exceedingly difficult even when an exhaustive study and a thorough examination are made. Errors will occur when pain is remote from the point where it is felt by the patient. Most mistakes in diagnosis might be prevented by pursuing an extremely cautious policy toward the extraction of suspected teeth.

No tooth should ever be condemned to extraction without some logical reason for its removal or without definite evidence that it is diseased beyond repair. The roentgenogram will usually supply that evidence.

I do not mean to imply that the roentgenogram can establish a positive diagnosis in all cases of obscure pain. I am aware that the roentgen rays cannot detect a sclerotic sinus membrane or a tic douloureux, but it can prevent the extraction of innocent teeth. Any tooth suspected of causing pain will, if it is responsible for the patient's distress, give some evidence of disease in the well-made roentgenogram. No disease can originate in a tooth and extend to the alveolar process without first passing through the barrier of the peridental membrane, the tissue outlining the tooth root and roent-

genographically bearing the most intimate relation to it. The fact that it is clearly outlined and that it responds so readily to abnormal influences makes it of utmost value in the detection of early disease changes.

When pain originates in a tooth, the roentgenogram will disclose some variation in the clear black image silhouetted against the dentin and the alveolar process. This variation is clearly depicted in the well-made roentgenogram and all it needs is a translation into terms of diagnostic significance.

The individual film is inherently positive, and it will not deceive, provided the conditions controlling it are known. The mistakes of roentgenography and of diagnosis can usually be traced to the meaning that the dentist gives to the picture.

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POSTGRADUATE ORTHODONTIC INSTRUCTION AND THE LICENSING OF SPECIALISTS*

By HOMER B. ROBISON, D.D.S., Hutchinson, Kan.

I AM cognizant of the fact that an attempt to deal with the subject of postgraduate orthodontic instruction and the licensing of specialists may call forth various opinions, because of the different types of courses given by various schools. Possibly an analysis based on experience in lecturing to various schools would not be amiss and might help to clarify many of the subjects now misunderstood.

Too often, we are like the three blind men who went to the circus to learn what an elephant was like. One felt the leg and decided it was like a tree. The second encountered the trunk and his version was that it was very much like a rope. The third touched the ear and vowed it was quite like a fan. Had they exchanged opinions and ideas, their decisions would have been much nearer the truth.

"Why don't you?" is an expression that is more recklessly and thoughtlessly used than possibly any other combination of words. I have used it many times in connection with our schools, when, had I known the real facts of the case, I might have recanted, and the same may be true of the attitude of the school men toward the general practitioner. We may say with Robert Burns, "Oh, could some power the giftie gae us, To see ourselves as ithers see us."

If the faculties feel that the schools and their pursuits are to be completely divorced from the great majority of our profession, namely, the nonschool men, the situation is doubtless in accordance with their desire. If not, there should be a closer relationship existing between the two, whereby they could each view the problems of the other.

Doubtless, more time and energy are wasted by our method of selecting a vocation than in any other manner. It is hoped that the plan of vocational guidance instituted in some of our schools will be an aid, and it is regrettable that more schools cannot adopt the plan. However,

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it is far from infallible, and many are still blundering on. That various types of people possess widely differing aptitudes is well established.

Merschewski points out that the basis of all anatomic lesions in the brains of idiots is an inhibition of the activity of nervous tissue. He states that in persons with unusual aptitude, the connection between the convolutions of the brain in certain regions is highly developed; while, in other regions, there may be an inhibition or functional lethargy. In other words, to be rated as a success in life one must be somewhat unbalanced mentally.

We must agree then that since all people are not cast on the same die, they possess varied aptitudes, and all are not aware of their possibilities on leaving school. A few years of general practice will generally reveal their special talents. For instance, if we select 1,000 persons in a high school group to be lawyers, 1,000 to be engineers, 1,000 to be dentists, etc., the law of averages would show a very small percentage in each group to be highly successful. If each is started on a general course and receives a sound foundation, and those with higher sensibilities withdraw from the group to specialize in the subject of their particular interest, the percentage of successes will be much greater.

Table 1.—Membership by Years

Year	Members A.S.O.	No. in Exclusive Practice
1920	140	78
1928	297	241
1936	422	366

I contend that none of the present methods of instruction are entirely satisfactory, and in the fact that I have lectured both to private and to university classes I find foundation for my contention.

As regards postgraduate instruction in orthodontia, I believe that we cannot put the undergraduate, the newly graduated and the man who has been in general practice for some time on the same level. The man who has been in general practice for years does not, in most instances, need the same curriculum as is needed by the inexperienced.

I do not wish to be interpreted as meaning that none of those who adopt orthodontia as a specialty when leaving school will be a success, but the highly successful men in all lines have been those who have been in general practice for some time and have discovered their aptitude for specialization, and who are conscientiously striving for greater knowledge and the advancement of their profession. It has always been and always will be that the men who find their special aptitude in their profession, either medicine or dentistry, after being in general practice for a time sufficient to determine their inclinations, are more successful than those who select their specialty while in school or on the immediate completion of their course.

I have no intention of minimizing the requirements of any specialty, but I am opposed to setting a definite number of hours for each person to regard as his education, regardless of his qualifications, and on completion of which he may be considered equal to those who have spent years in practice. There should be a discrimination in courses varying in accordance with the fundamentals already gained through general practice and natural aptitude in the field.

I am not going to suggest the criterion of proficiency, further than to state that we should forever dispel the idea that orthodontia is purely mechanical, and to stress the importance of a scientific back-

ground, considering the appliance merely an aid in correcting a biologic, physiologic and endocrinologic imbalance.

We should eliminate the deplorable condition existing as regards laboratory technicians' making a diagnosis or prescribing treatment from merely viewing a set of models. As the old-time physician did not go below the tongue for his diagnosis, so today the technician sees only, from the model, that something is wrong.

I do not want to leave with you the impression that it is experience alone, with no special training, which makes a good specialist: far from it. Every one who attempts to practice a specialty should spend some time in intensive training in his special work. I do say that one who has been in general practice, is adept at technic and realizes the need for and is versed in the scientific phases of dentistry and the collateral subjects that go to form a basis of orthodontic requirements can certainly acquire the same proficiency as the beginner and in less time.

The thirty-nine dental schools in the United States are situated in thirty-one cities and twenty-two states; twenty-six states, or more than half, and many cities being without a school. Of these schools, only thirteen are giving courses in orthodontia. Now surely all the talent does not exist within the confines of the cities in which postgraduate courses in orthodontia are given. Dentists are seldom blessed with great wealth and their obligations are such that the long terms make it impossible for many of them to take steps in preparation for advancement. Many would prefer to increase the hours and shorten the term in order

Table 2.—Data on Various Schools (1920)

Course	Members A.S.O.		In Exclusive Practice	
	No.	Per Cent	No.	Per Cent
Dewey	55	62	33	38
Angle	46	61	29	39
No course	30	75	10	25
International	9	64	5	36

Table 3.—Data on Various Schools (1928)

Course	Members A.S.O.		In Exclusive Practice	
	No.	Per Cent	No.	Per Cent
Dewey	111	59	77	41
None	99	58	71	42
Angle	56	49	58	51
International	19	39	30	61

Table 4.—Data on Various Schools (1936)

Name	Members A.S.O.		Exclusive Practice	
	No.	Per Cent	No.	Per Cent
No course	152	61		39
Dewey	143	62	88	38
Angle	46	42	64	58
International	37	53	33	47

to cover the work required, instead of consuming time merely to comply with a condition. Many schools are adopting the plan of allowing students to advance according to their abilities, giving examinations to determine their proficiency.

The University of Chicago has adopted some such plan, called the Chicago College Plan. It seems that this plan is especially adapted to postgraduate work. Following is an excerpt from a letter from George A. Works, dean of students and university examiner, of the University of Chicago.

> I think that the idea of adaptation to individual differences is practicable in dealing with postgraduate work in medicine and dentistry. In fact, when I spoke before some members of the staff of the Dental School of the University of Illinois, I suggested to them that I thought it would be possible to give more recognition to those individual differences than is customary in schools of dentistry. You are free to take any statement from this letter that you wish.
>
> (Signed) GEORGE A. WORKS.

There are, or have been, cases in which a dentist in general practice, residing within a city where a school was situated, took the course offered and carried on a very successful general practice, gaining the same, or even greater, efficiency and yet spending much less time in the lecture room. I am not critical of this method; in fact, I have followed the plan closely and find some of the men who have so acquired their education have been very successful orthodontists. But what of the man who lives some distance from the source, who must spend fewer hours and more weeks merely to comply with a condition?

In checking over the rosters of the orthodontia departments of our Universities, I find that most of the deans were either graduates of short term courses or none at all. I have always held the highest regard for the orthodontic ability of these men, and it is evident that they must have gained their knowledge by some short-cut method, or some extra-hard work in addition to their general practice. Surely, the personality of men has not changed so materially that it will be impossible to find such men today.

In no event should a school issue a diploma or any instrument signifying proficiency until the student has practiced at least two years and then returned to the school and given a thesis, or case reports, showing his interest and achievement in his vocation. Should he reside in a foreign country and the effort of returning be too great, the thesis or report could be submitted to the faculty for their approval.

Going from one extreme to another, we have schools that are giving a few weeks' course, not necessarily calling it a complete course. Many of their students are launching forth and declaring themselves specialists and practicing orthodontia and destroying many of the tenets left by our founders. Surely there is a solution to this problem. My deduction doubtless has faults, but, in the main, I believe it is workable.

There always have been and always will be men who attempt to enter a specialty looking merely at the remuneration or the social status that they believe it will gain for them. It is this type that prostitutes the profession, and their activities must be curtailed. Our faculties and state boards will, I believe, handle this.

To convey an idea of the advance of orthodontia, its membership, the number of graduates from various schools, the number in exclusive practice and the number of members of the American Society of Orthodontists, the accompanying tables have been prepared. To try to strike an

average, I checked the first Orthodontic Directory of America, later issued as the Orthodontic Directory of the World, without a date (probably 1920). The next one was issued in 1928, the latest in 1936. The results are given in Table 1.

The number of members in the three schools of orthodontia, with the number of followers of each in exclusive practice, and those never having had any course, for the year 1920, are given in Table 2.

Forsythe and Harvard are listed, but had no men in exclusive practice.

In 1928, we have seven courses and one grouping under "no course."

In 1936, we have seventeen schools and a grouping under "no course."

I have presented these statistics to show that, with all our university courses, all the students that are in exclusive practice in 1936 are slightly more than one-half the number of those who have had no course and are in exclusive practice, not to mention those who have had short courses. The fact that in 1936 the largest percentage of A. S. O. members were among the no course men substantiates my former statements that we can have good men outside schools, or in shorter term schools.

Again I say that unless we meet this problem, we will have more men taking up orthodontia without any special training than ever before, and also it will make it much harder to establish examining boards for specialists.

Another phase I would touch on is that of licensing specialists. I am heartily in favor of doing so; in fact, I see no bona fide reason for not viewing it as a safeguard to the public. The opposition to the principle will probably come from those incompetents who feel it will brand them. I believe that the Oklahoma law is very just to the objectors. Any one can practice any phase of dentistry, but must pass the board examination before they may declare themselves specialists. I grant this is somewhat of a compromise, but most surely it is a step in the right direction.

Following is a letter from W. C. Travis, secretary of the Board of Governors of Registered Dentists of the State of Oklahoma:

I have your letter of inquiry concerning our reaction to the plan of licensing specialists in the practice of dentistry. In reply, I shall say that for the short time it has been in operation it has worked well, in that the board has been enabled to help protect the public from charlatans and quacks, who are always ready to set themselves out as being able to do any kind of work in the dental line.

Our law has been in effect only one year, and, of course, there are many things that may come up yet to thwart our best efforts. We were unable to get our anti-advertising section through the Legislature, but we have found that this specialists' section helps us materially to hold the advertising in check. We have a number of advertisers that have been asking for a specialist's license in prosthodontia, saying they have spent ever so much time in doing that kind of work. But because our law specifies that to be a specialist, one must have a year's training in that special subject or its equivalent, the board has pointed it out to them, at least those that have as yet presented themselves, that they have not had the prerequisites of a full course in school, much less the special requirements. Hence, we have refused even giving them an examination.

As for the disadvantages, I can think of none at present. Of course, the advertisers say it is discriminating, but we feel that it is perfectly justified and merely a protection to the public.

This is in substance the answer I received from all of the boards of governors of registered dentists.

We owe Dr. Sorrels and his committee a great deal of gratitude for their untiring efforts in inducing the dental journals to discontinue carrying the untruthful advertising by the various laboratories.

A PLEA FOR AN EXCHANGE OF THOUGHT BETWEEN THE GENERAL PRACTITIONER AND THE SPECIALIST*

By OREN A. OLIVER, D.D.S., F.A.C.D., Nashville, Tenn.

THE specialist and the general practitioner are playing in the same game. Our ideals, our struggles and our interests are the same, for, in common, we attempt to build or restore normal occlusion and, although we deal with different aspects of the same subject, we meet on common ground.

In the last quarter of a century, we have seen dentistry grow and expand to the point that he who runs may not read all her aspects, which are too manifold and intricate to be dealt with in detail by one person.

Each man has his trend or forte, and be he specialist or general practitioner, he will be lured by certain phases of dentistry that appeal to and inspire his imagination, or tempt him by seeming more productive or lucrative. "To him who in the love of (dentistry) seeks communion with her visible forms, she speaks a various language"—too various indeed and complex for one mind to follow to their completion. And so, because of these varying trends, inspired often by a peculiar aptitude in some particular field, specialists have arisen, with their value and their limitations. As one of these, I acknowledge the debt we owe to the general practitioner, and I admit and maintain that a knowledge of general dentistry is indispensable to any specialist in any field of dentistry. There are as many phases to dentistry as there are facets to a cut and polished gem, and all are necessary to perfect its brilliance.

Occasionally, the specialist strays too far from the general field and, as often, a general practitioner wades too deeply into the specialist's enclosure, and both find difficulty in making themselves understood. Our fathers found profit in barter and we too can benefit by a frequent exchange of ideas.

Orthodontia has grown largely out of the observation and experience of the general practitioner, but many of these, having given birth to the child, seem inclined to desert it, and this paper attempts to show that neither can get along happily without the other.

Ages ago, it was observed that teeth would move. The influences producing this condition were noted—a drifting or tipping after extraction, or elongation of a tooth that has lost its antagonist. Also, it was noted that mouths were changing constantly, and that certain characteristic forms and irregularities would result from certain conditions, such as habits and mouth breathing. On this vague hypothesis, dentists reasoned that if teeth would move without mechanical appliances, they could be made to move with them, and from this observation and inspiration, orthodontia had its birth.

At that time, the conception of movement was based purely upon the idea of elasticity of bone, in the belief that if sufficient force was applied, teeth could

*Read at a meeting of the American Academy of Restorative Dentistry, New Orleans, La., November, 1935.

be pushed or pulled into more desirable positions, and, if they were maintained there a sufficient interval, resistance to the movement would become passive and the teeth would retain their changed positions.

All of this was empiric, uncertain and experimental, for each individual case represented difficulties that invited failure and often inflicted damage lasting throughout life. "The evil that men do lives after them; the good is oft interred with their bones." These failures, when studied, are valuable, for out of them may come knowledge.

Pridefully, we can say that orthodontia has undergone a vast evolutional change, for, upon the primitive observation of the ancients and their archaic deductions, there is being reared a structure, the orthodontia of the future, founded upon the fundamentals of scientific fact and therefore strengthened with the simplicity of truth.

The premise of orthodontia is that of every other branch of medical science, that to secure desired results, the practitioners should be familiar with the normal, with the origin of the tissues within his field, with their development and with their destiny. Thus, by comparison, he may recognize the abnormal. His reason next should be directed toward those conditions that might arise and disturb the forces and functions of the normal, so that they may be anticipated and opposed by the knowledge born of experience.

To the trained mind, thus armed, the question may arise: "Is intervention necessary or may not Nature right this wrong?" If not then, when is the most opportune time to assist Nature to help her just enough and not too much, a push or a pull, torsion, but never a distortion?

My object in saying this is to emphasize the fact that the mechanical movement of teeth is a definite therapy—just as much as the prescribing of a drug to remedy some organic disturbance, or an appendectomy, aiding Nature by the riddance of a hopelessly diseased and threatening appendage. So the insertion of an orthodontic appliance in the mouth is the mechanical expression of a means of assisting Nature to her goal, the normal.

It has been said that the main objective of all dentistry is the restoration and maintenance of normal occlusion, and this is probably true of all the phases of dentistry with the exception of exodontia. Normal occlusion implies that all the teeth in one jaw occlude with the teeth in the opposing jaw, so as to furnish the largest area of balanced grinding surface. The cusps, the inclined planes and the sulci into which they fit should combine to furnish the ideal masticating apparatus, and should form dental arches which, in strength and durability, are unsurpassed. The cusps of all the grinding teeth in such an arch should mesh with their antagonists, any variation either to buccal, lingual or anteroposterior relationship being prevented, provided a harmonious pressure is exerted by tongue, cheek and lips.

This regularity of the teeth in normal occlusion is one of the chief factors in their resistance to decay and to diseases of the periodontal tissues; for, if the teeth are normally placed and properly formed, they are in position to be as self-cleansing as possible. Black ably shows this in his statements regarding the correlation of hard and soft tissues.

Occlusion is not lawless in spite of the fact that there are varieties and numbers of types of occlusion described, such as prosthetic occlusion, centric, eccentric and traumatic occlusion. Certain practitioners have the printed slogan in their operating rooms "Study Occlusion," showing that the profession recognizes

occlusion as a keynote objective. Therefore, it is apropos to state a law of occlusion.

LAW OF OCCLUSION

This law of occlusion is based on the fact that in all living organisms which have the most diversified forms of teeth, there is a characteristic common to the majority of each species; namely, the crowns of the teeth of opposing dental arches are in a mechanical relation which, in the transient approximation of function, is adapted to the food habits of each species—and man is omnivorous. In all the varieties of form seen among the individuals of different species having teeth the occurrence of this condition is so nearly constant as to justify the assumption of a natural law. The transient approximation of tooth surfaces is called occlusion, and the uniformity of the occurrence of this phenomenon in nature is referred to as the Law of Occlusion. This law refers to the uniformity of the physical relation of the teeth in function, and it does not refer to any one type of occlusion—not even to normal occlusion.

The law of occlusion is the basic principle of dentistry, as it is the fundamental truth upon which the science of dentistry is built. Let us see whether this is true. Back of all the operations of dentistry, there is the basic purpose to establish or maintain normal occlusion and to maintain or provide normal functional activity of the masticatory apparatus. To accomplish this, the natural form and relations of the teeth are restored or preserved. The filling of a tooth, the treatment of an alveolar abscess, the construction of an artificial substitute, the modification of the supporting structure of the teeth by the use of an orthodontic appliance—all these are doomed to failure unless normal functional activity is sought and achieved. To achieve this end, let us consider as a practical revising basis Hellman's hypothesis of occlusion, which links the phenomena of occlusion with the evolution of the denture as a whole, or is, in other words, the biologic concept of occlusion.

1. The contact of the labial surfaces of the lower incisors with the lingual surfaces of the upper incisors.

2. The point of fossa contact, as in the points of the lingual cusps of the upper bicuspids with the distal fossa of the lower bicuspids.

3. The ridge and embrasure contact, as in the triangular ridges of the buccal cusps of the upper bicuspids and in the lingual cusps of the lower bicuspids between those of the upper series.

4. Ridge and groove contact, as effected in the triangular ridges of the mesiobuccal cusps of the upper molars and the buccal groove of the lower molars.

In considering what we call the cusp value of the molar series, we find that the mesiolingual cusps of the upper molars are the protocones of the original tritubercular forms, and that the mesiobuccal cusps of lower molars are the original protoconids. The manner of their interdigitation in occlusion shows these cusps to be of primary importance in maintaining the normal anteroposterior relationship of the teeth. The occlusion of the protocone, the mesiolingual cusps of the upper molars, with the talonids of the lower molar is a relation of great importance. In fact, the occlusal relation of the mesiolingual cusps of the upper first molar in the central fossa of the lower molar is the center about which the evolution of the human denture in the molar region revolves; the fact that it is the center of the greatest functional activity clearly indicating its importance and the necessity for its preservation.

The lingual cusps of the upper bicus-

pids and the buccal cusps of the lower bicuspids are the original protocones and protoconids, respectively, and, therefore, are the cusps of the greatest stability and functional importance in the development of occlusion. Tomes pointed out that the more primitive parts of the teeth occlude with later developing parts in forming the grinding surface. This knowledge is essential to appreciation of tooth forms and is fundamental in all dental restorative work.

Every dentist will admit without argument that, with few exceptions, teeth missing from the dental arch should be replaced with artificial substitutes that the integrity of masticating function may be maintained and drifting, tipping, extrusion and consequent traumatic occlusion may be prevented. Also, he will admit that the most important phase of orthodontia for the general practitioner lies in the care of the deciduous teeth and the development of the denture, as well as its growth and health and efficient function, the index of which rests in the maintenance of normal occlusion. Each unit or tooth in the deciduous set should be retained for its normal term of service, and not extracted until the presence of its successor, has been determined, and should extraction be compulsory, a means of saving or retaining space for the latter has been provided.

The second phase for the general practitioner involves the search for and correction of pit and fissure defects, which Black says are "the most easily found and the most frequently overlooked." He should determine what untoward habits are present and have knowledge of their effects. This is of paramount importance, for these effects are evident while the general practitioner is in charge of the case, and it should be humiliating to call a specialist to correct what he could have anticipated and averted. It is better for him to deal with "cause" than have to have "effect" treated.

Since the succession of the deciduous denture by the permanent one is an intricate process, it is evident that in the majority of cases, malocclusion of the teeth becomes apparent between the ages of 4 and 8 years. In the complex processes of development and growth, the fine order or balance is most frequently disturbed at this time, and when Nature has been interfered with in her effort to harmonize development and growth, it is better to lend aid then rather than wait for more serious complications to ensue. I do not of course mean that every slight aberration from the regular order between the ages of 4 and 8 should be immediately treated with appliances. A knowledge, based on observation and experience, which is free to us all, can inform us as to when we should give Nature the benefit of the doubt, for it is as serious a responsibility not to treat as it is to treat, especially with certain ages and conditions to consider.

Treatment may be wrong; lack of treatment may be wrong, and too much or too little of anything is always wrong. The experience and study of the practitioner determine his ability to evaluate cause and effect, never forgetting the elasticity of Nature in surmounting obstacles or handicaps.

Milo Hellman has pointed out that the head grows and develops downward as well as broadening out as infancy progresses into maturity. This growth he emphasizes in a graphic way. Consider his comparison carefully in order to appreciate downward growth. The profile outline of a new born baby's head when superimposed on a similar drawing of an adult's head rests within the cranial cavity of the latter. When it is realized that the teeth and other structures are thus moved in developmental progress,

the grave danger of early treatment without positive assurance of its urgency becomes evident. Cases of malocclusion do, of course, develop which occasion deep regret that early treatment was not undertaken. We have to share and wish to share this responsibility with the general practitioner. His is the first responsibility; ours the blame if disaster occurs.

As normal mouths do not come under the care of the orthodontist, it is the duty of the general practitioner to be alert and prompt in recognizing the beginning of malocclusion. This is a grave responsibility, and the apathetic or indifferent practitioner, the man who slights his task because of a distaste for children's dentistry, may have mouths under his care that are a living indictment of his methods.

The principal business of childhood is growth and development, and it is our task to observe progress and lend asistance when it is needed. If we are to recognize normal progress and development, we should carry in our minds a detailed picture of bone development at different ages and stages; for bone changes are constant in childhood. The bone corpuscle scarcely becomes an adult cell before its nucleus divides: the cell wall contracts and two cells are thus produced. This process continues into old age, except that it becomes slower and the cells drift apart, which increases the intervening space of calcium phosphate and other constituents; which we call ossification. This constant proliferative process renders bone subject to flow in the direction in which there is stimulation and this single vital force is helpless against the influences to which it may be subjected: faulty function, such as mouth breathing, abnormal occlusion, untoward habits or orthodontic force. Orthodontic appliances attempt to direct this current into its proper channel.

A plant may bend in its growth, being attracted by the sun, and become distorted in shape. We do not consider bending or breaking such a plant to straighten it: we turn it around. The object and design of appliances is movement of teeth and transportation of bone, but, as with the plant, we do not wait to act until the resilience, adaptability and pliancy of youth is lost. As we are dealing principally with childhood, it is well at this juncture to mention the importance of metabolism and to confess that too little is known about calcium metabolism. Certainly the sources of calcium phosphate are known to include such foods as milk, whole grains, vegetables and fruits. Also, it is known that more than one third of the actual volume of calcium assimilated is distributed to build bone and teeth.

As it is on the delivery of this tooth and bone building material that tooth position and movement depend, it cannot be questioned that our knowledge should include diet, metabolism and assimilation of calcium by mother and fetus in each case under our care, if the patient is to attain health and vigor.

The most assured law in nature is that of variation. If there were five identical cases of malocclusion in children of the same age, treated in precisely the same way, it would be safe to say that one would respond better than the others, one less and the three others somewhere between the two extremes. This condition is due to natural physical variation of basic cell metabolism, and applies particularly to calcium metabolism when the dental mechanism is considered.

If the general practitioner loves his work and is gifted with imagination, there is in the orderly care of a child's mouth a satisfaction and a thrill which can be obtained in no other service. It is like a romance which we read in serial

form, anxiously awaiting the next chapter. We may see the child again after an interval of normal development and get the pleasure that comes with the fruit of orderly care and planning; or we do not see this, but an ugly picture, wherein there is evident to the man who has been untrue to his trust a tragedy, malocclusion, with its unfortunate sequelae—a reproach to him who has not kept the faith.

The general practitioner, most of all, should feel this responsibility sufficiently to make an early diagnosis of malocclusion. No doctor should be above seeking consultation, and, in more difficult cases, the service of a specialist should be sought, with one aim in mind at all times, a maximum improvement.

The diagnosis of occlusion depends on the shape of the upper arch, the shape of the lower arch and the relation between the arches. It can be readily assumed that the normal is a highly individual affair.

The variation in the volume of tooth substance as well as facial outline is such that no mathematical rearrangement of the teeth can be recognized as a formula to apply to every individual. There are a few landmarks that should be recognized as constant factors in every mouth. The upper cuspids are an important factor in expression and should occupy positions of prominence at the corners of the mouth. Beginning with the cuspids, the posterior teeth should diverge in straight lines uniformly backward. With these points given, the first law of arch form then becomes the fact that there should be enough room between the two cuspids for the four incisors. If there is a discrepancy in one of the lateral divisions of the posterior teeth, such as an interlocking of the second bicuspid, this condition should be corrected first in treatment, so that the remainder of the arch form, when it comes to expansion and the study of occlusion, can be rendered uniform across both sides. After expansion, the final steps relate to the alinement of the anterior teeth. This plan of study applies to the lower arch as well as to the upper, and to the assumption that the state nearest to symmetry to which an irregularity can be brought must be very close to normal for that individual. Unless the upper deciduous teeth have been lost prematurely, it is reasonably safe to assume that the upper first molars have a generally constant relation within the skull, although this cannot be invariably relied on. In diagnosis, as far as the relative position of the mandible is concerned, it is safe in the majority of cases to study the relation between the upper and lower first molars in centric occlusion. If the mesiobuccal cusps of the upper first molar occlude well within the buccal embrasure of the lower first molar, it may be safe to assume that the mandible is neither anterior nor posterior to the normal. In such a state, treatment is indicated only for the upper and lower arches individually. Such a case is generally recognized as a neutrocclusion and, on the basis of the backward or the forward position of the mandible, the condition may be recognized as a posterior occlusion or an anterior occlusion.

It would be a great help to both the orthodontist and the general practitioner if there were a fuller realization of the complexity of the orthodontic problem, for a more sympathetic understanding would result and much unjust criticism be eliminated. The old erroneous idea that the chief requirement for successful orthodontic practice is the ability to manipulate mechanical appliances seems to have a firm hold on the dental profession. This misconception is doubtless fostered by the numerous advertisements

of orthodontic mechanisms appearing in our professional journals, some of which make extravagant and misleading claims. Regardless of the virtue, or lack of virtue, of these commercialized products, this proves confusing to the uninitiated, and diverts attention from that more important knowledge of biologic fundamentals, so essential to his own successful practice.

We cannot ignore the endocrines as influencing growth and development. The definite knowledge in this field is meager. Such specific knowledge as has been given us is considered, and we anxiously await development in this field. As it applies to our problem, we should always keep in mind that we are dealing with complex living organisms, and also that mechanical replacements or procedure should always be considered not only from the standpoint of mechanics, but also with an anticipation of the resultant physiologic affects.

Orthodontists and the other specialists are striving no more faithfully than the general practitioner toward our mutual ideal. And so we meet on equal ground in our desire, but hedged in by differing limitations. Can we not gain greater strength in greater unity? I mean unity of thought and effort, each with sympathy and appreciation of the problems of the other, which can only be possible when prevailing thought is mutual. So let us profit; for in barter there is profit.

We are reminded of the statement of Conklin: "The development of a human being from a germ cell is the climax of all wonders, greater than that involved in the evolution of a species or in the making of a world. The more thoroughly investigated, the more complex we find the natural phenomena to be. Nature is always greater than our theories, and, with few exceptions, hypotheses which were satisfactory at one stage of knowledge have to be extended, modified or abandoned as knowledge increases."

A NEW METHOD OF STAINING THE DENTAL PULP

By M. IKEDA, D.D.S., Fukuoka, Japan

IN the histologic study of the pulp, the tooth is first decalcified, and the pulp stained as a whole and then sectioned; or the pulp is sectioned first and then stained by various methods and studied microscopically. All specimens produced by these methods show the pulp cut transversely or longitudinally. Our histologic knowledge of the pulp hitherto was synthetic, being studied from those specimens that show only one piece of nerve fiber, with its origin and endings.

T. Ikeda studied under Prof. T. Morowoka the histology of the innervation of the tympanum, intestine (Auerbach's plexus and Meissner's plexus), and gallbladder, and the Ramon y Cajal impregnation and the Gos or Schultze silver impregnation method. T. Ikeda and Morowoka never sectioned the material by microtome, but obtained (in 1926) the whole natural shape of the nerve with its origin (nerve cell or plexus) and all courses of the nerve fiber and its endings, and published our findings. About four years ago, I began the study of the innervation of pulp by means of methods published by many authors.

By a new method, which T. Ikeda and his teacher introduced successfully, I made many compressed specimens, mainly of the dental pulp of the albino rat and the human being, taking special care not to destroy the natural shape nor cut it by the microtome.

I made an extensive research and reached some new conclusions, as here recorded, on which criticism is cordially invited.

Fig. 1.—Pulp of rabbit molar near apical foramen.

Fig. 2.—Specimen shown in Figure 1. The nerve fiber has already grown into a solitary fiber in the vicinity of the apical foramen.

MATERIALS

I used rabbits chiefly for the material, because they are numerous and are easily obtainable. I gave a butcher a standing order to send in the heads of rabbits that were killed for the meat, and I had him kill the animals by cutting the carotid artery and allowing them to bleed to death. The dental pulp thus obtained is different from that of a rabbit killed by any other methods. I also used human teeth that I had extracted in my clinic. Owing to the difficulty of getting materials, I could not extend my study in detail to other kinds of animals. The results of my research described here are based chiefly on the teeth of rabbits and several human teeth.

EXTRACTION AND FIXATION

Both the upper and the lower jaw of the rabbit is cut off and the teeth are extracted and immediately put into 10 per cent formalin for fixation before postmortem rigidity takes place. About two days later, the teeth are taken out and the hard parts around them are destroyed

in order to extract the pulp with meticulous care and thus prevent it from being injured. We must remember these two facts: The pulp of teeth within the jaw kept in the fixation solution does not become satisfactorily fixed even after a long time. On the contrary, if the teeth in the fixation solution are destroyed too soon, the separation of the pulp is not easy. Therefore, it is better to take out the pulp when it has become moderately fixed.

The pulp extracted by the method described is kept in the 10 per cent formalin for about one week, and then removed to one of 15 per cent, to be left therein for a few days. This treatment can be given the extracted teeth of the rabbit as well as human teeth.

The time that the materials shall be kept in the fixation solution depends on the form and thickness of the materials. The human teeth are treated in the same way as the rabbit teeth before the pulp is extracted.

PRESSING METHOD

In the histologic study of a nerve, the hardened materials are either stained as a mass and then sectioned by a microtome, or sectioned by a microtome first and then stained. My specimens are stained in quite a new way. To make the hardened materials as thin as pos-

Fig. 3.—Nerve fibers in root canal running upward, parallel to one another. The area to the right is near the odontoblasts.

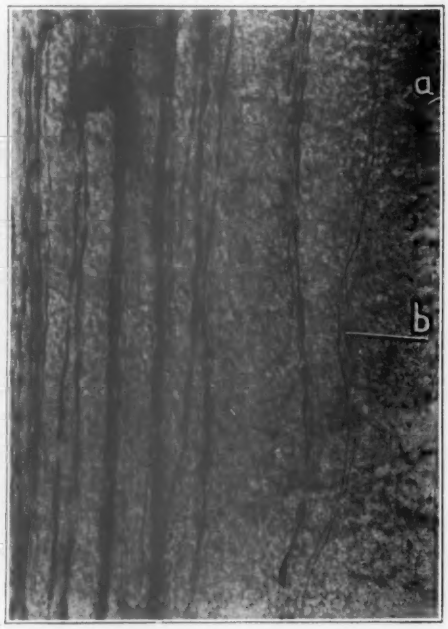

Fig. 4.—Nerve fiber running into root canal. The area to the right is near the dentin. *a*, odontoblastic layer; *b*, small nerve fiber running along root canal wall under odontoblasts.

sible by pressing and then to impregnate the nervous tissue, the following special procedure is carried out:

Two pieces of plateglass measuring 1.5 cm. or more in thickness, and a dish large enough to hold these pieces of plateglass are provided. The pulp, extracted in the manner mentioned above, is put between the two pieces of glass and then put into the dish filled with formalin solution, for the necessary hardening.

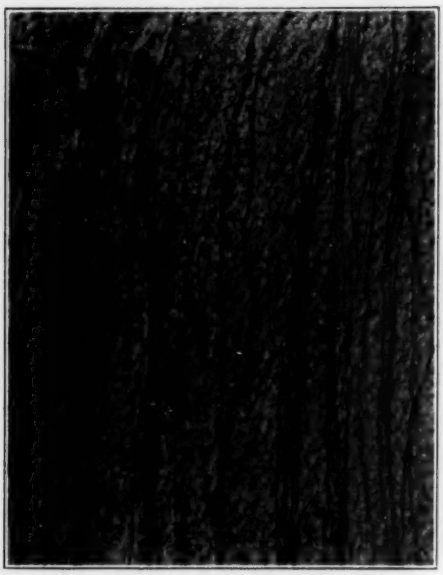

Fig. 5.—Nerve fiber running through middle part of pulp chamber.

Fig. 6.—Apical one third of pulp of upper cuspid. The nerve fiber bundles form a great band.

After about twenty-four hours, the pulp is almost flattened. It is then taken from between the two pieces of glass and put into the formalin solution in the dish. Now, the plateglass is compressed by having a metal plate placed on it. The pulp and the metal plate must be placed on the center of the plateglass so that the pressure may be exerted to the maximum and uniformly. It is entirely for this reason that plateglass is preferred. After twenty-four hours of pressure, the pulp is taken out from between the pieces of plateglass and allowed to harden in the formalin solution for a day and a night. It is then again put between the two pieces of plateglass and placed in the formalin solution. A heavier metal plate is placed on the glass for twenty-four hours. Pressure and fixation are repeated from three to five times. The pressure must be increased each time.

Particular care is necessary as the tissue of the pulp is destroyed if pressed too heavily before it has been sufficiently hardened. Excessive fixation makes flattening by pressure difficult. This treatment is stopped when the tissue has

ceased to get thinner and flatter. It is allowed to harden for yet another day before impregnation is made.

If we carefully practice these methods and become skilful, we shall be able to obtain an undestroyed thin piece of pulp tissue without the aid of the microtome; that is, by obtaining a thin piece of pulp, we have specimens that show all formations of pulp in the almost natural condition of tissue not sectioned. The flattened specimen obtained by these methods is estimated to be as thick as 200-300 microns, though it has never been accurately measured. In these specimens, the formation is very seldom found to be destroyed, when viewed under the microscope. Pressing is done in the dish filled with formalin solution; which keeps the tissue from being destroyed and hardens it in the formalin solution for the pressing. When it has been pressed to a certain extent, the space between the two plates of glass becomes less and less and the tissue is pressed continually, so that it is not wetted by the formalin solution. The main reason for keeping it in formalin solution is to prevent it from drying up.

Fig. 7.—Specimen shown in Figure 6; apical two thirds of nerve fiber. *a*, curve of nerve fiber bundle; *b*, bow-shaped nerve fiber.

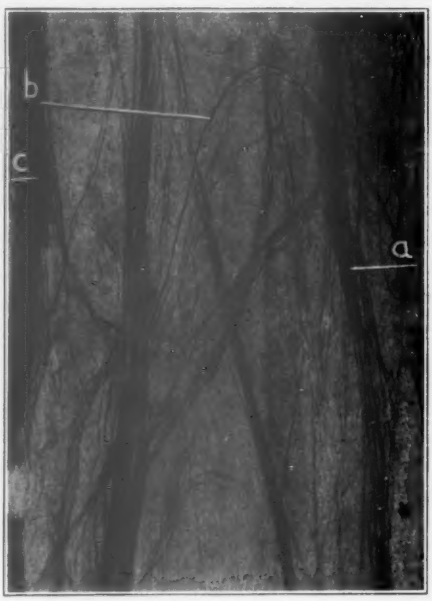

Fig. 8.—Distribution of nerve fiber in part of root canal.

IMPREGNATION

Numerous methods of impregnating the nerve histologically were used in the past. Among them, Bielschowsky's, Ramon y Cajal's, Stöhr's, Gros's and Golgi's methods are well known. But any method of silver impregnation of the nerve is comparatively difficult and calls for much experience and perseverance, as every one who has practiced it is aware.

Especially, it often happens that one method which assures success, and with comparative ease, in impregnating the central nervous system is attended by many unexpected difficulties when applied to impregnation of the peripheral nervous system.

For example, even if the chemicals are handled with particular care as to details and kept very clean, precipitation of silver appears in the specimen and the nerve fiber cannot be so satisfactorily impregnated as one may expect. The connective tissue is in some cases impregnated too much and it becomes very difficult to differentiate the nerve elements from it.

Therefore, plenty of experience is necessary to achieve success in silver impregnation: "Perseverance, cleanliness and correct procedure" should be the motto.

Judging from the result that I have obtained, Gros's impregnation method is the best of all for study of the innervation of dental pulp.

Let me describe here the Gros method itself and also how I adapted it to my present purpose.

Gros's Silver Impregnation Method.—This method, which is suitable for demonstration of the shape or the fibrils and pericapsular plexuses of the vegetative nerve cells, can be applied to the sympathetic ganglion cells and their neurofibrils. The material is:

1. Fixed in a 10 per cent formalin solution for several hours.
2. Placed in a 20 per cent solution of silver nitrate and allowed to remain an hour.
3. Passed through a 20 per cent formalin solution several times.
4. Placed in a watch glass containing 20

Fig. 9.—Nerve fiber in vicinity of pulp horn.

Fig. 10.—Specimen shown in Figure 9, highly magnified.

per cent silver nitrate to which a few drops of ammonia are added. (The preparation should be watched and controlled under the microscope, until a good picture of the nervous element appears.)

5. Placed in a 20 per cent solution of ammonia and allowed to remain for a few minutes.

6. Passed through distilled water to which a few drops of glacial acetic acid are added.

7. Transferred to the following solution: Distilled water, 10 c.c. and 1 per cent chloride of gold, 5 drops.

8. Placed in 5 per cent fixing soda, acidulated, and allowed to remain half an hour.

9. Washed thoroughly in distilled water.

10. Dehydrated in graduated alcohol.

11. Cleared in carbolxylene.

12. Embedded in xylol balsam.

Fig. 11.—Specimen shown in Figures 9-10.

Besides this method, the following method of silver impregnation is used in this study. This was initiated by

Oscar Schultze and improved by Stöhr.

1. After complete fixation in 10 per cent formalin, the material is kept in a 4 per cent solution of nitric acid for about forty-eight hours.
2. It is washed repeatedly in fresh water.
3. It is kept for twenty-four hours in 10 per cent solution of silver nitrate.
4. Reduction is carried out in a 50 per cent formalin-hydrochinon solution, with constant control under the microscope.

Fig. 12.—Nerve fiber plexus in vicinity of pulp horn.

Fig. 13.—Specimen shown in Figure 12. There is separation of the nerve fiber bundle in the vicinity of the pulp horn.

5. The material is washed in water for twelve hours and dehydrated by the use of alcohol. Carboxylene-balsam is then employed.

My new method based on the original method of Gros is as follows:

1. Fixation and pressing are carried out as described above.
2. As an end-reaction, when the material has been kept in a 20 per cent solution of silver nitrate about an hour, the material becomes brown. I keep the material in the silver nitrate solution until the compressed material is brown. In the original method, the thickness of specimen is determined microscopically for convenience in studying it; but, in my case, the thickness and size depend on the end-reaction in each instance. The silver nitrate solution must be in sufficient quantity, as the coloring in the end-reaction seems very difficult and more of the solution must be added in the course of impregnation. This not only does not retard impregnation, but sometimes even facilitates it. The material must always be under control, even during the night.
3. The material is kept in 20 per cent formalin solution about one to two minutes. This is an important deviation from the original method.

4. An ammonia-silver solution may be made, as in Bielschowsky's technic, in the watch glass, with a silver nitrate solution placed in it. Enough concentrated ammonia must be added to make the ammonia-silver invisible. Careful control is needed. If 1 drop of ammonia is put in in excess of the requirements two to three drops of silver nitrate must be added. The material may be left in the ammonia solution until it is colored completely dark brown, regardless of time. All the process of impregnation with silver is preferably sheltered from sunlight, the use of a dark room being strongly advised. Otherwise, the work is better done at night.

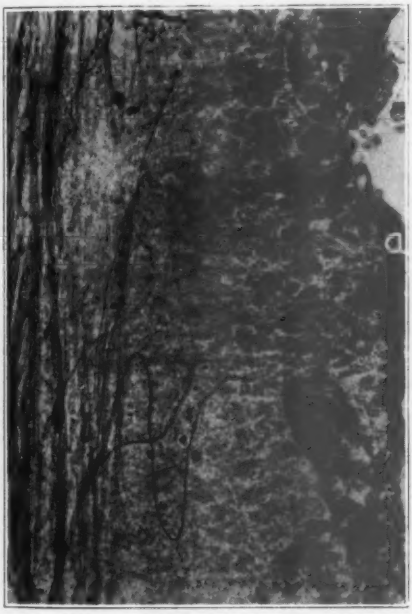

Fig. 14.—Specimen showing relation between nerve fiber and odontoblasts.

5. After washing in acetic acid, the pieces should be washed in running water.

6. Impregnation with gold chloride is the same as any other impregnation method. At any rate, the gold may replace silver, and the color, instead of brown, may be violet in this case. The time required in every case cannot be fixed definitely.

7. The other parts of the work require no particular instructions.

MICROSCOPIC VIEWS

1. *The Dental Pulp of the Rabbit.*—I selected the molar teeth of young rabbits because of the comparatively wider pulp cavity and apical foramen. Figure 1 shows the pulp of these molar teeth near the apex. Many nerve fiber bundles of various sizes, each of which consists of from five to twenty myelinated fibers, run from left or right, or crosswise. (Whether these are artefacts or not is uncertain.) Sometimes, ramifying upward for some distance, these bundles lose their usual characteristic and run straight along the longitudinal axes of teeth. In exceptional cases, as shown in Figure 2, groups of fibers are not in bundles, but run somewhat crosswise, tending upward and never ramifying, as in the previous figure, and running parallel to one another the whole course of the pulp from the apex. Figure 3 shows the nerve fiber, of which the upper, the apical portion of the pulp, near the pulp cavity, runs almost straight upward to the crown, as a single fiber or in bundles of at least two or three or, at most, six or seven fibers, never forming a great nerve fiber bundle. Remarkably, there are a few nerve fibers around the pulp near the odontoblastic layer, most of which are two or three single fibers, not bundled, and running through, under the odontoblastic layer, straight upward to the tooth crown. (Compare Figs. 3-4.) Figure 5 shows the nerve fibers of the middle part of the pulp cavity. As will be seen, the nerve fibers are not in bundles, but single or in groups of two, four or five, parallel to one another, only certain fibers appearing to ramify. Some-

times, the course of the nerve fiber is wavy, but it cannot be decided whether it is naturally so or this is an artefact. It may perhaps be the latter. The nerve fibers of the molar teeth of the young rabbit, extending into the root canal from the apical foramen as many small nerve bundles, and in the near region branched and then running straight upward, single or in bundles of several nerve fibers parallel to one another, along the longitudinal axes of teeth, reach the pulp horn or its vicinity, and the nerve fibers show no tendency to branch, and never undergo reticulation in their course. A single fiber seldom shows any branching.

Though I have not been able to observe clearly the relation between the pulp and the odontoblastic layer, I can, from a summation of all observations of many specimens, state that under such an odontoblastic layer, only comparatively finer nerve fibers, in small numbers generally, run along the wall of the pulp cavity, on the surface of the dentin. I seldom find finer fibrils penetrating among the odontoblastic cells.

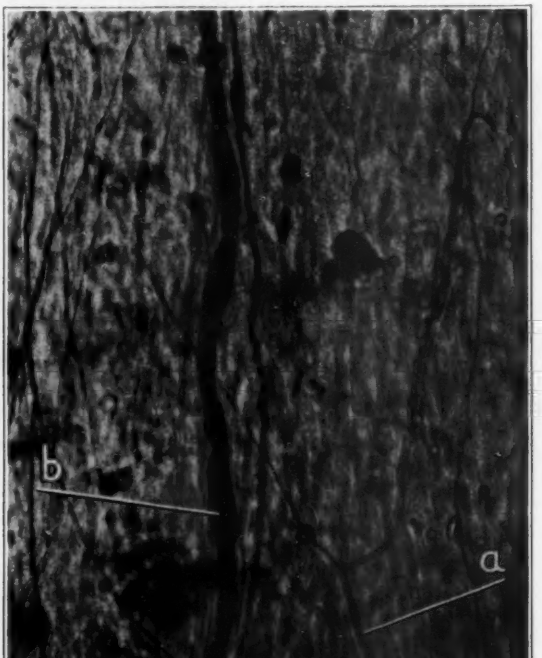

Fig. 15.—Branching nerve fiber of various sizes. *a*, fiber with branch; *b*, thick nerve fiber.

2. *Human Teeth.*—I have no new observation to make regarding the nerve fiber of human teeth beyond what many authors have made, except for few results obtained by my new method.

As is well known, not only the width and size of the pulp cavity, but also the size and condition of the pulp usually depend on the age, the kind of teeth, the systemic condition, etc. But here is an example of the pulp of the upper cuspid of a young man, in which the course of the nerve fiber from the apical foramen to the crown is straight upward, rarely branching, and in various sizes of bundles.

The nerve fibers are of various sizes, but larger than those of the rabbit; that is, some consist of from twenty to thirty, others from eighty to 100 of various grades. Besides, I have sometimes found nerve fibers consisting of only one, or in bundles of three or four. The bundles of nerve fibers run straight upward, swelling, without any branching as far as the middle part of the root canal. From thence, the higher up the fiber runs, the greater the number of branchings, and the more complex. Some of these are branched into communication fibers. Some of them are separated into several small fibers or remain as a single one. A few of them are curved in a bow-shape and turn back again toward the root apex. The branching or separation of the nerve fiber bundles happens most frequently in the region of the pulp cavity, at the lower two thirds of the whole pulp, measured from the root apex. The region hence to the pulp horn is full of branches of nerve fiber, and the fiber repeatedly branches in this way, many smaller fibers resulting, and crossing each other to build a nerve plexus or network.

Figure 6 shows the pulpal nerve fiber of the upper cuspid, the lowest one third from the root apex. *e* consists of twenty-three nerve fibers; *d*, of four nerve fibers. *e* is separated to build two branches of ten (*a*) and thirteen, the former of which runs upward in combination with the neighboring nerve bundle. Large fiber bundles of this kind pass mainly through the central part of the pulpal root. At the periphery of the pulp, in the neighborhood of the odontoblastic layer, nerve fiber bundles are rare, only two or three comparatively small nerve fibers running along the longitudinal axis of the tooth and sometimes ramifying to approach the odontoblastic layer. (Fig. 6 *b*.)

Figure 7 shows the nerve fiber of the upper two thirds of the apical foramen, above that shown in Figure 6. As will be seen in Figure 7, the nerve fiber bundles have already branched into various sizes of bundles and cross and complicate one another, and some of them branch out to form an arborization or plexus. Especially at *a*, about twelve or thirteen fibers curve rapidly and sharply downward and reach *b*, where they are bow-shaped and again turn upward and unite into another nerve fiber bundle.

Figure 8 shows separation, anastomosis, complication and combination of nerve fibers in a position a little higher than that shown in Figure 7. The nerve fiber bundle situated at *a* is separated into two, the left one of which curves very obliquely downward to the left and then ascends to unite with the nerve fiber bundle *c*. The two or three nerve fibers shown at *b* are curved into a bow-shape, and run downward. These turning or anastomosing nerve fibers are seen everywhere, and are seen to be especially abundant in the crown on careful examination.

Figure 9 shows a part of the pulp horn, where almost all nerve fibers separate into single fibers, becoming entangled again and crossing one another to build a network or arborization of nerve fibers.

Figures 10 and 11 show these areas magnified and the entanglement of the nerve fibers.

Figure 12 shows many nerve fibers, branching and becoming entangled with one another in a network in the vicinity of the pulp horn of the second upper molar. This section is a little too thick and was mixed with many other pieces of tissue, which makes it appear dirty, in consequence of which the microscopic observation was difficult, though the general outline is plain.

Figure 13 is the same section as is shown in Figure 12. The nerve fiber rapidly curves and splits in the vicinity of the pulp horn. I regret that the section is mixed with many pieces of tissue, which prevents a clear observation.

Figure 14 shows the nerve fibers that form a network directly under the odontoblastic layer, some of which taper to finer neurofibrils and penetrate among the odontoblastic cells. Two or three neurofibrils end here, somewhat enlarged. The relation between the odontoblastic layer and the nerve fiber is not evident, as I stated with reference to the rabbits, but it can be safely stated that finer fibers doubtless branch and penetrate between the cells. It seems almost impossible to study the endings of nerve fibers more exactly in the section that I stained after Gros's method. At times, I recognized rather larger fibers, which penetrate between the cells and reach the dentin.

RESULTS OF IMPREGNATION BY GROS'S METHOD

As is already well known from hematoxylin-eosin and myelin staining methods, the pulps of rabbits and human beings are mainly myelinated fibers with Schwann's sheath. Though those fibers which innervate the pulp are in greater number than in the other organs, it is well known that functionally they act no more than to convey all pain impulses. Gros's method, which I modified for my purpose, stains only the cylinder axis, and it is very hard to dye myelin or Schwann's sheath with this method. Sometimes, it appeared that the myelin or nucleus of Schwann's sheath cell was stained, but such a result is probably due to some error.

The sizes of nerve fibers vary very much, but every bundle in the pulpal cavity is greater and the fibers are linked together in knots; which makes its nucleus structure observable. It may perhaps be the nucleus of Schwann's sheath, which might have been stained accidentally. On the contrary, the nerve fiber branched at the peripheral pulp or pulp chamber, as Figure 15 shows, is sometimes greater, but generally grows so fine that its end cannot be found, even at a maximum magnification. It cannot be decided here whether these facts indicate weak points of Gros's method or are the results of my unskilled technic.

I could not observe anywhere how the solitary fibers, the so-called bare cylinder axes, branch off; that is, whether cylinder axes are separated into many neurofibrils. As seen in Figure 13, it sometimes happens that one single fiber separates into two branches in its course or separates into fork-shaped branches directly under the odontoblastic cells. Judging from the results that I have obtained to date, Gros's method is so suitable for staining the nerve fibers in pulp that even its end portion can be impregnated clearly. But the nerve fiber endings among the odontoblastic cells, and, moreover, the relation between the odontoblastic cells and dentin, were not presented in greater detail, in view of which this method may not be declared the best for these purposes.

CONCLUSION

1. When the pulp of human beings and rabbits is extracted, fixed in formalin, compressed by weights and then stained after Gros's silver impregnation method, we can study in their entirety the nerve fibers of the dental pulp. The facts brought forth are different from those which can be obtained by study of the sectioned specimens.

2. The molar pulp of young rabbits has the nerve fibers evidently in bundles in the apical foramen, but branched in this part, running directly upward and at last separated into many fibers, or running along the longitudinal axes of the teeth, forming bundles in scattered places.

3. Rarely are there nerve fibers in the neighborhood of the odontoblastic layer and the nerve fibers running along the surface of dentin, and penetration of the odontoblastic layer is not very clear.

4. Human pulp has comparatively greater neurofibrils, coming from the apical foramen to form comparatively greater bundles, to branch off, to anastomose, to cross, to complicate and at last to build a fine plexus in the neighborhood of the pulp cavity or, especially, the pulpal horn.

5. The sizes of nerve fibers are widely different, the small fibers being difficult to recognize even at a great magnification.

6. We can recognize the nerve fiber penetrating between the odontoblasts, but the delicate form of its ending is invisible.

This research is still not quite complete, and I shall publish from time to time any further results that may be obtained. Bibliography will be given later.

VINCENT'S INFECTION

By W. E. GOODROW, D.D.S., Del Norte, Colo.

THE San Luis Valley, comprising five counties located between two mountain ranges in southwestern Colorado, last spring had an epidemic of Vincent's infection. Many of the acute cases, a majority of which were among school children, were in the care of private practitioners. Many of these children were suffering from deficiency diseases, the infection appearing as an aftermath of influenza, scarlet fever and other illness confining the patient to his bed.

When any number of school children were examined, many were found to have symptoms of Vincent's infection. Twenty-two Civilian Conservation Corps candidates, from a county contingent of thirty-six, were rejected because of Vincent's infection. These facts brought the urgency of the situation to the attention of the public, and an appeal was made to the American National Red Cross, through its St. Louis office. This organization sent its medical director and certain staff members to Southern Colorado to gain first hand information regarding the epidemic, and to develop a plan of relief. A rapid survey, including the examination of a number of school children, revealed the need for an emergency clinic for the treatment of this very contagious disease.

Before the clinic was set up, the advice of the Colorado State Dental Association, Colorado State Department of Public Health, Official Emergency Relief Administration and other organizations was sought. With the support of these agencies, the operating unit was set up immediately.

It was concluded that the condition of the mouths of the school children would be an accurate index to the mouth condition of the whole population. Therefore, the first step was the examination of school children for clinical symptoms of Vincent's infection. This was a visual examination, the examiner using a tongue depressor as a retractor. The information obtained was entered on a record card. Smears were taken in all suspicious cases and sent to the State Department of Public Health at Denver for microscopic laboratory examination. The positive cases were then diagnosed from the clinical and laboratory findings. Positive laboratory findings were reported only when organisms were present in great numbers.

When a positive laboratory report was received, the child was asked to bring every member of his family to the clinic for examination. When the findings were positive, the financial status of the family was investigated, and, if possible, they were referred to a private practitioner for treatment. If the family was indigent, all infected members were treated at the clinic.

It was decided that it would be necessary to treat all cases in which laboratory reports were positive, in order to eliminate all "carriers" as well as the chronic and acute cases.

An ordinary flat wooden toothpick, which makes an ideal instrument for obtaining bacteria from the deeper part of the pocket, was used, without cotton, for taking material for smears. Unless the material is obtained from the subgingival crevice, many positive cases will be overlooked, because of the anaerobic nature of these bacteria.

A few statistics will explain the scope of this project. The total number of persons examined was 9,404. The number of positive cases of Vincent's infection diagnosed from clinical and laboratory findings was 3,782, 40.21 per cent of positive cases.

The total number of microscopic examinations was 5,543. Slides were not taken if there was no apparent gingival or mucous inflammation. Individual routine treatments to the number of 16,174 were given, or an average of seven treatments per case, including medical treatment given by the nurses, scaling by the hygienists and the extraction by the exodontist. The number of hopelessly decayed and abscessed teeth extracted was 2,670.

As this work was carried on among the indigent of these communities, the number of patients referred to private practice for treatment was relatively small.

In the acute cases, the outstanding clinical symptoms were ulceration and inflammation of the marginal gingivae, especially interproximally. They were characterized by sudden onset and the appearance of the ulcers covered by a gray slough, most frequently located at the gingival border and on the mucous membrane of the cheek. The slough could easily be removed, a red hemorrhagic surface being exposed. In many cases, there was constant drooling. The sublingual and submaxillary glands were palpable and tender. Often, the tongue was coated and painful. The interseptal tissues were separated and stood away from the teeth, which were in many cases loosened and sensitive to pressure. In numerous cases, the ulcers appeared on the external surface of the lips. A fetid odor of the

breath, which was always present, seems to be a distinctive characteristic of this disease. In almost all of the cases, the tonsils and throat were found to be involved. Deglutition was very painful.

A review of the literature on Vincent's infection indicated that many writers before 1929 doubted the existence of a chronic stage. Since that date, most authors agree that chronic Vincent's infection is very common, and that the condition often becomes acute, owing to lowered resistance of the patient. In these chronic cases, the patients are undoubtedly carriers, and many acute cases can be traced directly to them.

The symptoms of the chronic stage were not nearly so marked as those of the acute infection, and pain was either reduced or totally absent.

The gingival tissues were bright red and looked edematous, especially the points of the papillae. When the case was carefully examined, typical ulcers were found in certain areas of the mouth, most often in the lower incisal area or around a partially erupted mandibular third molar. Many cases presented edematous hypertrophied papillae, which extended a considerable distance toward the incisal edge of the teeth. This was especially true of the younger patients. The distinctive fetid breath was present in all of the chronic cases. The onset was gradual and unnoticed by the patient. The submaxillary and sublingual glands were not swollen nor tender. The mouths of these patients were badly neglected, with broken down teeth and heavy calcareous deposits. Many chronic cases gave a history of an acute stage. Because of improper treatment or absence of treatment, the disease became chronic, and the patient a dangerous "carrier." Vincent's organisms and chronic clinical symptoms were found in many persons who had apparently had no acute stage. As "carriers," they were capable of transmitting the infection to others, and they were also susceptible to an acute infection whenever their resistance was lowered.

Many were suffering from malnutrition, resulting perhaps from lack of dairy products, fresh vegetables, and fruits. About 80 per cent of the malnourished were infected. It seems that a deficiency diet renders one more susceptible to Vincent's infection, and an adequate diet is a great aid in treatment.

From the results obtained in treating a large number of patients, it appears that most chronic cases clear up under oxygen-liberating drugs, 5 per cent chromic acid, hydrogen peroxide and sodium perborate. In addition to any medical treatment, it is necessary to establish an excellent condition of oral health. For the more obstinate chronic cases and the acute cases, it was found advantageous to use a combination of oxygen-liberating drugs and the arsenic compounds, such as Fowler's solution (solution of potassium arsenite), arsphenamine or neo-arsphenamine.

The treatment that proved most effective was application of 5 per cent chromic acid to all infected tissues and rinsing of the mouth thoroughly with a solution of equal parts hydrogen peroxide and corrosive mercuric chloride 1:1,000 aqueous solution, with daily treatment of ulcers and fissures with chromic acid and solution of potassium arsenite. All teeth were scaled and polished as soon as the acute state subsided. A mouth wash of sodium perborate was used by the patient four or five times daily. For obstinate cases, 10 per cent arsphenamine or neo-arsphenamine in glycerin was substituted for the solution of potassium arsenite. Neo-arsphenamine was more effective than arsphenamine. These two drugs were used in powder form; but it is very difficult to apply and control the action of the powder.

Three per cent solution of iodine in alcohol, Dakin's solution (surgical solution of chlorinated soda), potassium chlorate and a 1:1,000 solution of potassium permanganate were used, but found not so effective as the arsenic compounds.

After the symptoms of Vincent's infection had disappeared, and an excellent state of oral health had been attained, all hopelessly diseased teeth were extracted. Partially erupted third molars were removed to eliminate the pockets they form, which are residual areas for Vincent's organisms. It is necessary to remove all infected teeth to eliminate Vincent's infection from the mouth.

The treated cases were reexamined a month after dismissal. Most of the mouths were found to be healthy and clean, the percentage of recurrence being very small.

It is widely accepted that the important etiologic factors are a spindle-shaped bacillus and a long spirillum. The relation of these two micro-organisms, the bacillus and the spirillum, has been the subject of much speculation. Some bacteriologists believe they are two distinct species living in symbiosis, while others think they are different stages in the life cycle of the same organism.

The fusiform bacillus is a rod-shaped organism with pointed ends. It may be straight or slightly curved. The spirochete is very long and delicate. The curves or spirals are usually three or four in number and present a threadlike appearance. Both organisms stain well with carbolfuchsin.

Other important etiologic factors are: neglect of oral health, calcareous deposits on the teeth, the presence of ill-fitting crowns, partially erupted third molars and broken-down roots and malocclusion.

The project continued for six months. A considerable number of data were gathered and a large amount of treatment and educational work was carried out. The field is so large that more work should be done in studying in more detail and with more attention to accuracy the factors involved in the spread of Vincent's infection in these communities, before a complete picture of the situation can be obtained.

CONCLUSIONS

1. The incidence of Vincent's infection is very high, especially among indigent and undernourished persons.
2. From the history of the cases examined, the contagious character of this disease is apparent. Whole families and a large percentage of communities were found to be infected. All members of such families had neglected mouths.
3. Persons having chronic cases are an important factor in the spread of this disease as "carriers."
4. A combination of oxygen-liberating drugs and the arsenic compounds probably offers the most effective medical treatment.
5. Local application of drugs is more effective than intravenous therapy, as the organisms cannot be destroyed through the circulatory system.
6. Cases will not clear up with medical treatment alone. Careful scaling and a high standard of mouth health must be established.
7. It is necessary to eliminate all infected teeth to clear up completely a case of Vincent's infection.
8. A diagnosis of this disease depends on the correlation of the clinical and bacteriologic findings. A positive microscopic slide in the absence of obvious clinical symptoms indicates the person is a public health menace as a "carrier" and may have a potentially acute case.
9. The benefits of a project of this type are twofold: (1) as a public health measure and (2) as a dental health educational program.

10. Many advanced periodontoclasia cases can be traced to an acute Vincent's infection that was not properly treated. Vincent's organisms are an important etiologic factor in some cases of periodontoclasia.

11. People of all ages may be affected by this disease. Children are not more susceptible than adults.

12. Establishment of an excellent state of oral health and adequate nutrition are preventive measures against this disease.

Medical Building.

NATIONAL BOARD OF DENTAL EXAMINERS; SUCCESSFUL CANDIDATES, PARTS I & II*

Alloy, Jack	Temple University School of Dentistry
Blunk, Russell E.	Northwestern University Dental School
Campbell, Thomas J.	Chicago College of Dental Surgery
Cassidy, William J.	Temple University, School of Dentistry
Cody, H. Graley	Washington University School of Dentistry
Corthouts, James L.	University of Maryland, School of Dentistry, and the Baltimore College of Dental Surgery
Cronin, John W.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Cushley, John	School of Dentistry, University of Denver
DeShong, Robert Lee	University of Pittsburgh, School of Dentistry
Di Meo, William	Temple University School of Dentistry
Eberly, Glenn H.	Chicago College of Dental Surgery
Entine, Martin	Temple University School of Dentistry
Forestner, H. J.	Washington University School of Dentistry
Giddings, C. H.	School of Dentistry, University of Denver
Ginsburg, William L.	School of Dentistry, University of Denver
Goldblatt, Maurice	Atlanta-Southern Dental College
Goldstein, Morris	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Gornstein, H. C.	Chicago College of Dental Surgery

*The session for Part II was held May 22-23, 1936, in eleven centers.

*The names of Maurice Costello, Chicago College of Dental Surgery, and Sigmund Figenbaum, Temple University School of Dentistry, were omitted from the list of successful candidates previous to May, 1936.

Harrison, William J.	University of Pittsburgh, School of Dentistry
Hughes, J. William	Atlanta-Southern Dental College
Hutchinson, Austin P.	University of Pittsburgh, School of Dentistry
Ito, Takeshi	School of Dentistry, University of Denver
Klotz, Otto G.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Kreshtool, Louis	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Krupa, Michael S.	Chicago College of Dental Surgery
La Femina, James J.	Tufts College Dental School
Lake, Thomas H.	University of Pittsburgh, School of Dentistry
Lehman, Kester G.	Chicago College of Dental Surgery
Liedman, Sidney C.	Chicago College of Dental Surgery
McCooey, Clark J.	Chicago College of Dental Surgery
Mammen, Donald H.	Chicago College of Dental Surgery
Meyer, Everett Nelson	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Miles, W. S., Jr.	School of Dentistry, Medical College of Virginia
Miller, Benjamin R.	Kansas City-Western Dental College
Miller, I. Franklin	University of Pittsburgh, School of Dentistry
Mitten, Harry W., II	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Neibergall, Gerald M.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Newman, Herbert Paul	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Odlum, George B.	Tufts College Dental School
Ogle, Francis C.	Chicago College of Dental Surgery
Ohl, R. Wallace	University of Pittsburgh, School of Dentistry
Olszewski, Henry J.	University of Pittsburgh, School of Dentistry
Ostrowski, Edward J.	Harvard University Dental School
Parker, Charles C.	Harvard University Dental School
Patrick, Bernard F.	State University of Iowa, College of Dentistry

Philpot, William C. C., Jr.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Rogers, William J., Jr.	University of Pittsburgh, School of Dentistry
Rust, Austin J.	Chicago College of Dental Surgery
Sanders, A. L.	Atlanta-Southern Dental College
Sloop, William Martin	Atlanta-Southern Dental College
Straub, Robert L.	Chicago College of Dental Surgery
Sullivan, William F.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Swenson, Earle W.	University of Minnesota, College of Dentistry
Swift, Thomas H.	Harvard University Dental School
Tully, Edward A.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Tyburski, Francis C.	University of Maryland, School of Dentistry, and Baltimore College of Dental Surgery
Vensel, Richard R.	University of Pittsburgh, School of Dentistry
Walus, John W.	Tufts College Dental School
Webster, S. F.	Kansas City-Western Dental College
White, Ivan James	State University of Iowa, College of Dentistry

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C. N. JOHNSON, Editor

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Editorials

VINCENT'S INFECTION AND THE RED CROSS

One of the most dramatic and impressive demonstrations of service by the Red Cross was the attack on Vincent's infection ("trench mouth") in picturesque San Luis Valley, Colorado, in 1935.

It had been found that the disease had assumed epidemic proportions and was becoming extremely serious. With the cooperation of the Colorado Dental Association, Dr. W. E. Goodrow, of Del Norte, was secured to direct the professional aspects of the relief operation. Three nurses and two dental hygienists completed the staff.

The disease was found to be prevalent among school children, and attention was immediately directed to this group. Cooperation with the school authorities enabled the Red Cross to strike quickly and effectively.

Daily medication, individually prescribed by the dentist, quickly brought results in oral health.

Through the Junior Red Cross in the schools, educational infor-

mation on sound oral hygiene practice received attention, and daily toothbrush drills were held in class rooms. The use of salt water daily as a mouth wash was advocated, and toothbrushes were made available by the Red Cross to those unable to purchase them. Druggists reported an increase of 2,000 per cent in toothbrush sales. Complete cooperation of the entire dental profession in the valley materially aided the Red Cross in its work.

From April until November, nearly 10,000 persons had their mouths inspected, and approximately 3,000 extractions were made. The American Red Cross expended $4,175 in the oral hygiene project.

To detail all that was done is unnecessary here, as it has been recited elsewhere. But this is a concrete example of what cooperation may accomplish when a great and vigorous organization like the Red Cross takes the initiative and launches a philanthropic project. It might also be appropriate to say that in any emergency of this or similar character involving oral affliction, the dental profession may be relied on to do its full share in the alleviation of the difficulty.

We cite this as a conspicuous example of the efficiency and far-reaching philanthropy of this great organization, and we cannot help thinking that the following statistics constitute an eloquent demonstration of a major achievement with a minimum equipment:

Total number of cases examined	9,404
Number of cases of Vincent's infection	3,782
Number of teeth extracted	2,670
Personnel on duty	6
Dentists	1
Dental hygienists	2
Nurses	3

Volunteers assisted on intake work at the clinic and with other clerical work.

It may also be stated that the President Elect of the American Dental Association, C. Willard Camalier, has made an approach to the United States Public Health Service, requesting the establishment of a research project in this Colorado area, for the purpose of endeavoring to ascertain definitely the causes of this apparent epidemic, and looking to its future prevention and cure.

With the cooperation of the Red Cross and other civic and health agencies, it is hoped that, in the future, an epidemic like that in the San Luis Valley will be put under control immediately.

TWO MEN

In the dental profession, there are two men who, it appropriately happens, have been tendered dinners by their admiring friends in recent months. These men have characteristics in common. They are quiet and retiring in disposition, earnest and faithful in the performance of their duties and are not aggressive or over-reaching in any way. They have in their make-up the milk of human kindness. When it comes to the obligations of life, they are away ahead of the game—invariably they are doing more for other people than others are ever called on to do for them. When a word of commendation is given them, as it often is, they have the common habit of looking up in some bewilderment, much as to say "What have I ever done to merit anything like this?" And they are both genuinely surprised. Modesty is ever delightful, and modesty is the very essence of the lives of these two men.

On the evening of Sept. 22, 1936, a dinner was tendered by the G. V. Black District Dental Society to Dr. E. K. Blair of Waverly, Ill., on the occasion of his sixtieth year in practice and his eightieth birthday. Men and women came from every section of the surrounding country to honor Dr. Blair; from St. Louis, Chicago, Springfield, Jacksonville, Rock Island, Benton and elsewhere. The Illinois State Dental Society was represented by its president and its secretary. A member of the state legislature in the person of Dr. Stewart of Girard was there. Dr. Blair himself served in the state legislature for one term several years ago. Representatives of the dental schools of St. Louis and Chicago were at the dinner, as well as distinguished members of the medical and legal professions. Many speeches were made and messages received. Waverly is a place of only about 1,600 inhabitants, but there came to that small town on that occasion such an

outpouring of sentiment in honor of one man as is seldom witnessed. And it was all richly merited.

October 13, the Northern Illinois Dental Society gave a dinner to Dr. M. L. Hanaford, of Rockford, Ill., as a testimonial to his long service to the society and to the profession. Dr. Hanaford is the same type of man as Dr. Blair. If a single phrase might be used in connection with the two men it would be "faithful service." At the banquet to Dr. Hanaford, there were leading representatives of the profession from the entire area embraced by the Northern Illinois Dental Society and many from the outside. They were the same type of men who attended the dinner to Dr. Blair. As was stated at the dinner to Dr. Hanaford, he has always stood for the highest and best in his profession. Though beyond the eighty mark, his mental and physical attributes are not in the least impaired. His step is sprightly and his voice rings clear. Above all, he is an excellent operator.

There is something so very fine in the character of these two men that they form a good pattern of the better element of the profession in all sections of the country. They are the saving grace of dentistry and are an inspiration to younger men everywhere. Were it not for men of this type, the profession would soon lapse into a sordid tendency toward the tenets of barter and trade.

The true professional spirit never had finer representatives than Drs. Blair and Hanaford, and dentistry has need of just such men. The higher we go in the scale of ethics, the more substantial becomes our professional fabric, and out of the warp and woof of the daily lives of such men as these is woven the garment that shall clothe our ultimate destiny. Without men of this type, we would soon be bereft of the incentive and inspiration of our nobler ambitions, and lapse into mere mediocrity. With men like these, there is no limit to the development of those qualities that make professional life most worth living.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Washing Hands—Nothing is observed more closely around a dental office than how well you wash your hands.—*C. C. Norris, Oshkosh, Wis.*

Sitting at Work—Ninety per cent of dental work can be done while sitting. Why not conserve your physical energy?—*C. C. Norris, Oshkosh, Wis.*

Cleaning Water Containers—Muriatic acid will clean water containers. Do not empty into the water drain as it attacks lead pipes.—*C. C. Norris, Oshkosh, Wis.*

Root Resection—Root amputation should be mastered by the general practitioner, as it may frequently be needed in general practice. Teeth with large granulomas or small cysts may be saved by means of this procedure. The success of root resection depends to a large extent on root-canal therapy. Cases in which the root canals have been well sterilized and root-canals well condensed give fairly good results.—*James L. Zemsky, 147 Fourth Ave., New York City.*

Duplication—So much breakage occurs in both the old and the newer plate materials that the following system of duplication was devised. A new impression is taken in a tray and the model poured. The buccal and labial flanges of the denture are sawed off, also practically the entire palate and the heels about up to the last tooth. The horseshoe-shaped remaining piece will fit on the model very much as a bridge model fits into a bit. If the palate has been temporary, as a usual thing the shrinkage has occurred mostly in the flanges, which have been removed.—*C. C. Higby, Clermont, Fla.*

Appointments—A system of appointments for laboratory work not only keeps that work flowing smoothly, but also prevents worry lest it not be ready when the patient comes. Each case requiring laboratory work is listed in orderly sequence on a series of weekly cards as to the day on which it is due. A box with the patient's name on it containing the impressions is placed on a shelf within reach of the bench. Every odd minute between chair appointments can be utilized by referring to the list, for the next case not checked off as finished, and work started without loss of time. Since the system was established, in not a single case has the appliance not been ready. This method saves minutes every day, and hours every week and month. and increases office efficiency.—*Frank A. Delabarre, Boston, Mass.*

Advertising—Ethical dentists shudder at the sound of the word advertising. Some states by legislation are eliminating such violations of professional ethics. Routine is similar to monotony and dental work should never be done in a strictly routine matter of fact manner. With every patient something a little unusual should be done to register an impression of the dentist's best efforts. This might tend to show the limit of the dentist's ability in such a way that favorable comment might influence other patients. It is representative of an advertising medium that is justified and earned and is a reward for work well done. If nothing unusual is done, patients will have nothing unusual to say of their dentist. It is wrong to advertise, but advertising is right when patients do it for you.—*Herbert Ely Williams, Red Bank, N. J.*

That Semi-Annual Visit—Many patients hesitate in making semi-annual visits because of fear that always something will be needed. Prophylaxis is an absolute necessity for some persons, even at shorter intervals than six months, but that does not signify that everyone invariably must comply with a custom. Prophylaxis is required only in the removal of deposits which fail to succumb to the toothbrush and in other observances and treatments of the soft tissues of the oral cavity, including the tongue. Many patients believe such frequent visits are unnecessary and satisfy their belief in staying away longer than they should. Patients, hoping nothing will be found and praying that their hopes may come true, find no word more welcome to their anxious ears than "everything is all right this time."—*Herbert Ely Williams, Red Bank, N. J.*

Holding Confidence of Patient During Local Anesthesia—The first requisite in extracting is self-confidence, which reacts favorably on the patient. The patient looks to the dentist for reassurance and faith. We may think he does not notice our facial expressions, but he relies on them to find out whether everything is going smoothly. If he notices a cold sweat on our brows and a nervous reaction and tension in our faces, he is inclined to become jumpy and sometimes will himself terminate the operation without completion. It is advisable to premedicate in some cases to make the patient less conscious of the surroundings and more cooperative. Above all, we must not hurt the patient. Let us make sure that anesthesia is complete before beginning extraction. Dr. Schaeffer has said that a little more anesthetic will not be harmful to the patient. There are times when we are certain that anesthesia is complete and yet the patient will show expressions of pain. Here, dental psychology plays an important part. We must explain to him that there are different sensations, that of pain and that of pressure, and that he must distinguish between these. We are dealing with a neurosis rather than actual pain. After conveying this thought and reassuring the patient, we can usually proceed with the work. If we predict that a tooth will fracture, we must prepare the patient beforehand. He will not be so surprised or show shock when it happens. If there are several teeth to be extracted, we should choose the more simple first and strengthen the bond between the patient and ourselves; then, at another sitting, complete the more difficult extractions. Let us know our limitations. If we feel that the case in question is beyond our ability, we must not attempt it, but refer the extraction to one more competent. As we gain experience and knowledge we can handle the more difficult cases, but not until then.—*Julius Caplan, 4802 Broadway, Chicago, Ill.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following article has been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary*

DENTIFRICES*

Ephraim Dental Powder.—Composition: Each hundred grams is said to contain calcium carbonate-Sturge ("50"), 80 gm.; sodium bicarbonate, U.S.P., 19 gm.; neutral powdered soap, 1 gm., and flavoring, 1 gm.

ABRASIVENESS: Two and two-tenths milligrams per thousand revolutions (John & E. Sturge, Ltd., Instrument).

Manufactured and distributed by Jerome W. Ephraim, Inc., 91 Warren Street, New York City. No U. S. patent or trademark.

PY-RO-GO—NOT ADMISSIBLE TO A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary*

About October, 1935, dentists, particularly in the Chicago area, were addressed by one H. K. Brown, president of Py-Ro-Go, Inc. By way of introduction, dentists were advised:

In 1920 I founded Cook Laboratories, Inc., and introduced the "Carpule" to the Dental Profession. You are the best judge as to whether or not the idea has proved an asset to you in your practice.

Today I want to introduce to you another product which can also become a great asset to you and one which should open up a new avenue of profitable business for you.

So confident was Mr. Brown of the results of using Py-Ro-Go that he took pride in sending each dentist a standard size package, absolutely free.

Later, Mr. Brown stated that he no longer was connected with Py-Ro-Go, Inc. It is also believed that he no longer has any connection with the Cook Laboratories, Inc.

In the letter to dentists from Py-Ro-Go, Inc., appeared the following:

If you have hesitated to accept Pyorrhea cases because of the uncertainty of prevailing treatments, I want you to try PY-RO-GO and then judge for yourself how easy it is to apply and what pleasing results will follow—pleasing to you and pleasing to your patients. As a scientifically compounded formula, developed over a period of six years, PY-RO-GO has been subjected to the most exacting tests.

PY-RO-GO will be productive of definite—satisfying results in a remarkably short time.
It is in no way destructive to the tissues.
It does not discolor nor stain the teeth.
It can be used freely with no ill effects.
Its application is not painful.
Its taste is not objectionable.

*Accepted Dental Remedies, 1935, p. 91.

It is absolutely harmless.

In short, Py-Ro-Go should prove to be a very valuable aid to you in the treatment of the most severe cases of Pyorrhea.

If the dental addressee is as delighted with its use as other members of the dental profession are, additional packages may be obtained from his dental supply dealer for $4.50 each.

An attempt was made to secure from Py-Ro-Go, Inc., a statement of the composition and evidence upon which the claims were based. After a lengthy correspondence, the Council was advised, in effect, that the formula of the product was secret, and was further advised that " . . . if the profession does not wish to cooperate with us in our effort to provide them with *exclusive* use of PY-RO-GO we shall have to abandon our policy and market it through other channels and more particularly through the retail drug field where a substantial volume can be developed." This, in effect, is a threat that if the dentist does not help Py-Ro-Go, Inc., distribute their product through the profession, it will be distributed as a pyorrhea treatment on their own account.

As one views the results of the A.D.A. Bureau of Chemistry's examination, it is little wonder that Py-Ro-Go, Inc., did not care to divulge the composition of its product. The examination in the laboratory indicated that Py-Ro-Go will do no more, no less than a 12 per cent solution of potassium iodide, which alone has not been proved useful in the treatment of pyorrhea and the many gum conditions which pass under that name.

It is hardly necessary to comment on the name Py-Ro-Go as applied to a simple solution of potassium iodide; nor on the claim that it is the fruit of six years of research.

In view of the foregoing, Py-Ro-Go is declared inadmissible to A.D.A.

The chemist's report follows:

PY-RO-GO

Two original packages (professional samples) of Py-Ro-Go were received.

The following appeared on the carton:

Py-Ro-Go Valuable in the Treatment of Pyorrhea.

The following appeared in the enclosed circular:

Py-Ro-Go is a scientifically compounded formula for the treatment of Pyorrhea. It is the result of six years' study.

Absolutely harmless, it can be used freely and with confidence as to the results it will produce.

To those members of the profession who do not care to handle cases of Pyorrhea because of the uncertainty of prevailing treatments, PY-RO-GO will open up a new field of profitable endeavor. It will create new business for you.

Information concerning the composition is wholly lacking.

Each package contained 15 c.c. (one-half ounce) of a light yellow odorless liquid with a saline taste. Crystals appeared about the neck of the bottle. The liquid was neutral to litmus. The specific gravity was 1.085. The refractive index at 20 C. was 1.3490.

Qualitative tests indicated the presence of iodide and potassium. Phosphates, sulphates and phenols were not found.

Quantitative determinations yielded the following:

Residue on evaporation[1]	11.9 gm./100 c.c.
Ash 450 C.	11.8 gm./100 c.c.
Sulphated ash	8.0 gm./100 c.c.
Potassium iodide (titration with $AgNO_3$)	11.8 gm./100 c.c.

A solution containing 12 gm. of potassium iodide in water to make 100 c.c. was prepared. This was found to have a specific gravity of 1.085 and a refractive index at 20 C. of 1.3489.

1. The residue consisted of white crystals in the form of cubes.

In view of the foregoing, it may be concluded that Py-Ro-Go is essentially a solution of potassium iodide, 12 gm. in water to make 100 c.c.

POLORIS DENTAL POULTICE—NOT ADMISSIBLE TO A.D.R.

Poloris Dental Poultice was the subject of two examinations, one in 1933, the other in 1936. The second examination, consisting of a pharmacognostic and pharmacologic examination, was undertaken at the request of the Council by a pharmacologist acceptable to the Council. After considering the report submitted by the Council's consultant, the recommendation of the referee that Poloris Dental Poultice be declared not admissible to A.D.R. was adopted, and the Council authorized publication of the report.

SAMUEL M. GORDON, *Secretary*

Poloris Dental Poultice (Poloris Co., Inc., New York) is widely advertised in dental journals, through the mail and through distribution of free samples to patient by dentists.

The advertising reads:

Use and prescribe Poloris products before and after all instrumentation. Poloris Dental Poultice before treatment to relieve inflammation, congestion, irritation; after treatment to start counteraction before reaction sets in. (Oral Hygiene, January, 1936; Dental Survey, February, 1936.)

A booklet of prescription blanks, distributed with samples of Poloris Dental Poultice, gives the following formula on the covers:

Poloris Poultice
Capsicum—Counterirritant
Aconite—Anodyne
Hops—Sedative
Belladonna—Antisialogogue
Sassafras—Flavor—Anodyne
Gum Arabic—Demulcent
Oxyquinoline Sulphate—Antiseptic Agent

The poultice is advocated in the following conditions: 1. Pain after extraction. 2. Pericementitis. 3. Soreness after treating pyorrhea. 4. Vincent's infection (as an adjunct with treatments). 5. Incipient abscess. 6. Focusing seat of inflammation. 7. Erupting third molar. 8. Congestion in devitalizing. 9. Soreness after treating gingivitis. 10. Irritation after root canal filling. 11. Oral conditions during pregnancy. 12. Soreness under bridge or crown. 13. Dry socket. 14. Soreness due to new dentures.

On the sample package, it is stated that

Poloris has the endorsement of the dental profession in all parts of the world as the ideal treatment for relief of local pain due to abnormal conditions of the teeth and gums. Poloris relieves pain due to all inflammation, congestion, irritation, soreness, abscess and neuralgia of the teeth and gums.

The regular trade package bears this legend: "Poloris Dental Poultice—a local anesthetic for the relief of soreness due to all minor irritations of the teeth and gums."

Accordingly, this poultice appears to be endowed with an unusual number of important pharmacologic actions; that is, as a counterirritant, anodyne, sedative, antisialogogue, demulcent, antiseptic and local anesthetic. This wide array of alleged therapeutic actions and indications prompted the Council to request a referee to undertake a determination of the composition of Poloris poultice and its possible medicinal virtues.

Three packages of Poloris Dental Poultice were bought on the market and, in addition, several samples that had been received by dentists were collected. The trade pack-

ages contained five poultices. Each consisted of a small cloth bag containing approximately 0.25 gm. each of powdered drugs in leaflike form.

In 1933, A. N. Gathercoal, professor of pharmacognosy at the University of Illinois School of Pharmacy, was requested by the Council to examine the product by pharmacognostic methods. He reported that he could identify microscopically in these poultices ground-up hops in large amounts; sassafras root bark, capsicum and gum arabic in only small amounts, and some crystals of chinosol or oxyquinoline sulfate, but he could detect no powdered aconite or belladonna, said by the manufacturer to be present. A similar pharmacognostic examination was repeated as part of the current investigation. Large amounts of hops and small amounts of gum arabic, sassafras root bark, capsicum and belladonna root were found. Special pharmacognostic or chemical tests for cannabis, aconite, ipecac, squills and oxyquinoline sulfate were negative. From the pharmacognostic examination, it is concluded that the poultice is essentially ground hops with only small amounts, if any, of the other materials listed in the formula given by the manufacturer.

It remained to be determined whether the potent drugs said to be present could be revealed by typical pharmacologic actions. The following tests were made: One poultice was extracted with 10 c.c. of hot water. Three drops of the filtered extract were dropped into one eye of a rabbit every ten minutes for three hours. Aside from a little reddening due presumably to the presence of capsicum, this eye showed no changes in comparison with the opposite untreated one. The pupil was not dilated, nor was there any demonstrable local anesthesia. If there had been in the poultice enough of either belladonna or a local anesthetic agent to be of therapeutic significance, it could scarcely have failed to be revealed by a dilatation of the pupil or anesthesia of the eye, especially with instillation repeated for hours. A further test of local anesthetic action was made by bathing an isolated sciatic nerve of a frog continually for two hours in the poultice extract. No anesthesia of the nerve was produced, as shown by continued muscular contractions in response to electrical stimulation.

Because the most characteristic actions of aconite are the peculiar alterations of the heart beat and rhythm in the frog heart, frog hearts were exposed and irrigated with the poultice extract continually for two and one-half hours. During this time, there was no change in the rate or the rhythm of the beats. If aconite were present at all, it was not in sufficient amount to cause a demonstrable response even when the heart was bathed directly in it. The fact that the heart rate did not increase was further evidence of the absence of any significant amount of belladonna, since this drug would have increased the heart rate by paralyzing the vagus nerve.

Tests were also made in three human subjects by applying a control poultice consisting of ground hops between the lower gums and cheek on one side, and a Poloris Dental Poultice on the opposite side. Within half an hour, all three subjects noticed the bitter taste of the hops, on both sides, and a very mild burning on the tongue, produced by the capsicum in the Poloris. There were no burning sensations, nor reddening at the spots where the poultices were applied. Apparently, the capsicum or aconite was not present in sufficient amount for effective counterirritation. Similarly, there was no prickling or tingling of the tongue, which aconite produces in very low concentrations, this substance again failing to reveal itself, if it were present at all. All three subjects had a free flow of saliva, and therefore the claimed antisialogogic action of belladonna was not obtained. No demulcent action, from the acacia, could be detected. There was no local anesthesia of the surfaces on which the poultices were applied. As might have been predicted on the basis of common experience, none of the patients experienced any sedative action from the small amount of hops contained in these poultices. None of the subjects felt that there was any significant difference between the actions of the hops poultice and the Poloris, aside from the taste of capsicum.

These examinations and tests, therefore, show that Poloris Dental Poultice consists essentially of ground hops and that there are either no active constituents at all in it, or, if present, they are in wholly inadequate amounts to justify the claims as to counter-irritant, anodynal, sedative, antisialogogic, demulcent, antiseptic and local antiseptic action. Medicinal hops can be bought for about $1.25 a pound, and a pound of hops will make 1,800 such poultices, which would sell for about $90 if marketed at the price of Poloris Dental Poultice. Obviously, the price to the patient is entirely out of proportion to the value of the essential ingredient; and to any therapeutic effects which might be ascribed to such a poultice.

Poloris Dental Poultice, in view of the foregoing, is an irrational, unscientific, needlessly complex, ineffective and highly expensive mixture, which is marketed with extravagant and unwarranted therapeutic claims.

In the opinion of the referee, Poloris Dental Poultice is not admissible to Accepted Dental Remedies.

Phrase-Jugglery at Its Worst

We see phrase-jugglery at its worst as it is now being used to further the popularity of certain dentifrices. It is even more despicable than that formerly used by the manufacturers of so-called "fit cures," "consumption cures," and similar nostrums, because it is furtive enough in style to deceive much higher grades of intellect.

The discovery that oral sepsis is the primary source, or starting point, of many systemic diseases that were formerly attributed to other causes is one of the greatest developments of scientific investigation. Having established this momentous fact, physicians and dentists at once put forth their best efforts to impress the public with the importance of oral hygiene, or mouth-cleanliness, as a protective measure. The common awakening to the very serious mischief which may result from failure to keep the mouth clean was promptly seized upon by the manufacturers of certain dentifrices as a "golden opportunity" to enrich themselves. But it is well to bear in mind at this juncture that the discovery of the importance of oral prophylaxis, or dental cleanliness, was not made until popular enlightenment had advanced to a stage where none but the most gullible could be duped by such palpable falsehoods as were the chief reliance of the nostrum-makers of past times. If we fail to hold in mind this correspondence of intellectual advancement to the waning effect of the flagrant lie, the finesse of these present-day offenders is apt to escape our notice.—J. Madison Taylor *et al.*, in *J. D. Res.*, December, 1919.

BUREAU OF PUBLIC RELATIONS

RELATION OF PUBLIC HEALTH TO CHILDREN'S DENTISTRY*

By CHARLES F. DEATHERAGE,† D.D.S., Springfield, Ill.

THE major objective of any agency or profession in public health work is the prevention of disease and the promotion and protection of individual as well as community health. It is a generally recognized fact that the stability of any community depends on the health of that community, and we may go a little farther and say that the stability and health of the community of tomorrow depend to a great extent on the health of the children in that community today.

Dental diseases are more prevalent than any of the other diseases among the children and adults of our nation. Hence, dentistry becomes an integral part of any health service. Consequently, then, it becomes a responsibility of the dental profession to teach prevention early in life. In order to do this, we must develop dental health educational programs to include community education, school official, teacher and parent education, and last, but far from least, child education. These programs must be developed and conducted strictly along educational lines.

A program should be conducted with comparative ease, and properly supervised and should not work a hardship on any one. It should be a very definite, simple and comprehensive program; a program that will establish a better understanding and closer relationship between the public and the dental profession; a program that will teach the profession, as well as the public, its responsibility to the children of our nation. With this understanding in relationship, we can more rapidly bring about improvement in the health of our children, a result that will teach the parents the value and relationship of better health to the growing child. Such a program should be simple and definite and so planned as to be progressively educational and especially applicable to the various communities.

In the State of Illinois, such a plan is being conducted with the cooperation of the Illinois State Dental Society through the Committee on Mouth Hygiene and Public Instruction and the Division of Dental Health Education, Illinois State Department of Public Health. The Division of Dental Health Education was established in the Illinois State Department of Public Health by order of the Director, Frank J. Jirka, M.D., on recommendation of the Committee on Mouth Hygiene and Public Instruction of the Illinois State Dental Society, Nov. 1, 1935, and has for its main objective dental health education.

*Read before the Section on Children's Dentistry and Oral Hygiene at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

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The purpose of this paper is not to discuss a dental health educational program, but rather to show the relationship to dental health among the children, and how such a program will benefit children dentally, realizing that if children are given proper health training early in life, no doubt the parents will benefit. Therefore, I wish to discuss the methods and results of one phase of such a program, that of the dental health examination or dental health appraisal.

A dental health examination should not be merely a matter of looking in mouths, but rather an examination whereby we are able to help the teachers, school superintendents and principals to develop dental health educational programs in their schools that will benefit the children as well as the parents. In other words, we are making a dental health appraisal of the dental conditions that exist in that particular school just as a physician makes a health appraisal of the general health facilities and conditions of the school.

A well-organized dental health examination should be a medium by which the dental profession may reach the parents, teachers and children. This medium affords the profession an opportunity to point out certain individual defects that may, directly or indirectly, impede the

TABLE 1.—CHILDREN EXAMINED

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Number children examined	136	1155	1216	478	2985	31	450	317	6	804
Number parents present					777					
Number children examined with parents	133	796	320	10	1259					
Male	70	575	627	232	1504	15	242	160	0	417
Female	66	580	589	246	1481	16	208	157	6	387

TABLE 2.—INFANCY FEEDING (GROUP 1)

Breast fed	57	449	234	165	905
Number cavities	187	2029	611	504	3331
Number cavities per child	3.28+	4.51+	2.61+	3.05+	3.66+
Number first permanent molars decayed	6	407	281	211	905
Bottle fed	42	231	86	61	420
Number cavities	174	977	202	169	1522
Number cavities per child	4.14+	4.22+	2.34+	2.77+	3.62+
Number first permanent molars decayed	5	181	77	73	336
Both breast and bottle fed	33	122	24	13	192
Number cavities	103	439	46	45	633
Number cavities per child	3.12+	3.59+	1.91+	4.23+	3.29+
Number first permanent molars decayed	16	72	23	18	129

physical as well as mental development. It should serve to establish in one's mind the direct relationship between conditions of the mouth and general health and to impress on one the value of forming proper dental health habits, such as home care, proper diet and dental care, early in life, thus arousing a desire for better teeth.

With this in mind, the dental health examination becomes strictly educational and should be only a part of a well-organized dental health program. The best results are obtained when parents are invited to be present during the examination, as one of the most important phases of an educational program of this nature is the consultation with parents.

TABLE 3.—PREVALENCE OF DECAY

Grades	Group 1					Group 2				
	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Number free from decay	46	214	332	110	702	24	94	160	4	282
Number of cavities—degree 1	103	1063	952	246	2364	3	187	107	1	298
Number of cavities—degree 2	343	3332	1465	494	5634	16	920	189	3	1128
Number of cavities—degree 3	34	488	393	760	1675	0	271	35	0	306
Number cavities per child	3.52+	4.22+	2.31+	3.13+	3.24+	0.61+	3.06+	1.04+	0.66+	2.15+
Number first permanent molars decayed	13	927	1503	624	3067	0	249	210	4	463
Prophylaxis needed	122	990	1148	419	2679	13	112	102	0	227

PROCEDURE PRECEDING DENTAL EXAMINATIONS

The results and procedures of this report have been accomplished with the cooperation of the Illinois State Dental Society through the Committee on Mouth Hygiene and Public Instruction. This Committee has organized the different components of the Illinois State Dental Society in the following manner. Each component society appoints a chairman of the Mouth Hygiene Committee to be known as the component lieutenant. He, in turn, appoints one member for each county in his component to be known as a county lieutenant. This makes it easy for the Illinois State Department of Public Health and the Illinois State Dental Society to cooperate.

Several weeks before the dental health examination, the local dentist or school nurse is urged to secure proper publicity in his local newspaper. This article should give the schedule of the examination, and the name of the organization or organizations sponsoring the work, and should emphasize the necessity of parents' being present, so that the examining dentists may have an opportunity to discuss with the parents the condition found in their children. They are also urged to arrange with the sponsoring lay organizations for a meeting the evening preceding the examination, extending an invitation to all parents of the school children. This meeting is for the purpose of making clear the objectives of the examination, and an illustrated talk is given, using an exhibit showing the development of teeth and emphasizing the importance of prenatal care, infant care, early training in home

care, proper diet and dental care. Again, we stress the importance of having the parents present for the examination and making clear the fact that it is an educational program and no diagnosis will be made.

On the day of the examination, another talk is given to the mothers present, stressing the same phases and discussing the relationship of good teeth to good health, pointing out the position and importance of the deciduous teeth and the first permanent molar to the proper development of the jaws and the necessity of having defects corrected by the family dentist. Again we explain that the talk is strictly educational, no diagnosis will be made and only a mirror and an explorer will be used in the examination.

During the examination, each examiner is requested to wear a white coat, which will tend to acquaint the child with this procedure in the dental office. An examination of at least seven minutes per child is planned. This gives the examiner ample time to discuss with the mother the importance of retaining the deciduous teeth until their proper time

TABLE 4.—DENTAL CONDITION IN CHILDREN HAVING REGULAR DENTAL CARE

		Group 1				Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Number examined	12	173	217	94	496	31	369	206	6	612
Number cavities	31	643	396	177	1247	19	1057	207	4	1287
Number first permanent molars decayed	1	141	164	67	373	0	202	114	4	320
Number free from decay	7	40	78	34	159	24	84	130	4	242
Number having regular home care	8	105	126	61	300	31	330	188	6	555
Number having occasional home care	4	67	87	33	191	0	37	18	0	55
Number having no home care	0	1	4	0	5	0	2	0	0	2
Number with good oral hygiene	6	55	41	17	119	18	287	135	6	446
Number with fair oral hygiene	6	115	172	76	369	13	82	71	0	166
Number with poor oral hygiene	0	3	4	1	8	0	0	0	0	0
Dietary history: Milk	12	170	206	87	475	31	369	206	6	612
Dietary history: Fruits	12	165	208	89	474	31	369	206	6	612
Dietary history: Vegetables	12	160	210	86	468	31	369	206	6	612
Dietary history: Whole grains	12	161	177	64	414	31	369	206	6	612
Dietary history: Meat, eggs	11	166	202	89	468	31	369	206	6	612
Dietary history: Coarse foods	10	163	179	79	431	31	369	206	6	612
Dietary history: Sunbaths	2	41	18	9	70	0	0	0	0	0
Dietary history: Vitamin D	9	106	107	39	261	31	122	60	0	213
Dietary history: Excess of sweets	0	17	10	4	31	0	0	0	0	0

to be shed, the position and eruption time of the first permanent molars and their importance, the effect of bad habits and their probable causes, the value of training the child at home, the value of proper home care, diet and dental care, the relation of good teeth to good health and how the parent or guardian and urged to have the necessary corrections made. When the work has been completed, the dentist signs the notice and the child returns it to the teacher. We also give the parent, if present, or the child a pamphlet on teeth and their preservation, which is

TABLE 5.—DENTAL CONDITION IN CHILDREN HAVING OCCASIONAL DENTAL CARE

	Group 1					Group 2				
Grades	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Number examined	23	434	608	277	1342	45	99			144
Number cavities	111	1967	1425	918	4421	241	123			364
Number first permanent molars decayed	3	457	798	380	1638	34	91			125
Number free from decay	5	56	109	56	226	2	42			44
Number having regular home care	6	137	224	98	465	27	67			94
Number having occasional home care	17	288	365	173	843	17	31			48
Number having no home care	0	9	19	6	34	1	1			2
Number with good oral hygiene	2	54	33	23	112	25	77			102
Number with fair oral hygiene	21	374	538	251	1184	20	22			42
Number with poor oral hygiene	0	6	37	3	46	0	0			0
Dietary history: Milk	21	379	535	252	1187	45	99			144
Fruits	23	382	553	253	1211	45	99			144
Vegetables	23	375	529	260	1187	45	99			144
Whole grains	21	346	478	170	1015	45	99			144
Meat, eggs	22	371	514	251	1158	45	99			144
Coarse foods	14	327	405	237	983	45	99			144
Sunbaths	4	71	24	17	116	0	0			0
Vitamin D	11	188	244	57	500	17	37			54
Excess of sweets	1	30	36	16	83	0	0			0

teeth diseased in childhood may not show defects until adult life.

The most effective means of obtaining corrections is to have the mother present during the dental health examination. After the examination, each child needing dental corrections is given a notice for nothing more than an illustrated fifteen-minute talk dealing with the development of teeth, the value of home care, proper diet and dental care and the effect of bad habits. On the completion of the dental examination, a study and an analysis is made of the results of the work. This, as

a rule, is sent back to the superintendent in graph form, so that he, as well as the local dentist, will have an opportunity to discuss the phases of oral health in which the children under their supervision and care are below average. These results will provide them with information upon which to base future dental health programs.

During the school year 1935-1936, we are able to present a statistical report on 3,789 children whom I examined, using the new dental examination chart, known as the "Rhobotham Dental Record Chart." These children will be divided into two groups. The chart covering Group 1 presents information from the examination of 2,985 school children in fourteen counties where the prevailing occupations are farming, dairy farming, industry, mining, etc. Of these children, 516 attended rural schools. They have not had the benefits of a definite dental health educational program. The chart covering Group 2 presents information from the examination of 804 children who have had the benefits of a definite dental health educational program for a

TABLE 6.—DENTAL CONDITION IN CHILDREN HAVING NO DENTAL CARE

		Group 1					Group 2				
	Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
	Number examined	101	548	391	107	1147		36	12		48
	Number cavities	342	2365	994	355	4056		80	8		88
	Number first permanent molars decayed	9	401	520	177	1107		13	5		18
	Number free from decay	34	119	106	20	279		8	8		16
	Number having regular home care	19	193	101	37	350		22	3		25
	Number having occasional home care	64	332	257	66	719		11	9		20
	Number having no home care	18	23	33	4	78		3	0		3
	Number with good oral hygiene	5	60	16	4	85		21	3		24
	Number with fair oral hygiene	89	473	349	102	1013		14	9		23
	Number with poor oral hygiene	7	15	26	1	49		1	0		1
Dietary history	Milk	96	514	344	98	1052		36	12		48
	Fruits	99	524	361	98	1082		36	12		48
	Vegetables	99	509	366	101	1075		36	12		48
	Whole grains	87	461	319	68	935		36	12		48
	Meat, eggs	99	516	255	94	964		36	12		48
	Coarse foods	81	438	268	87	874		36	12		48
	Sunbaths	14	77	22	2	115		0	0		0
	Vitamin D	56	175	115	20	366		10	4		14
	Excess of sweets	5	38	24	7	74		0	0		0

number of years. This group includes the children in two orphanages, one in Peoria, Ill., which is an industrial town. These children are cared for by the parochial school dentist. The other is located in Belleville, Ill., which is an industrial and year. This accounts for 233 children. The remaining 571 children present a cross-section of the public school of Belleville, Ill., which has a dental health educational program supervised by a full-time dentist, devoting one half time to

TABLE 7.—DENTAL CONDITION OF CHILDREN HAVING REGULAR HOME CARE

	Group 1					Group 2				
Grades	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Number examined	35	493	402	194	1124	31	378	258	6	673
Number cavities	101	2094	816	532	3543	19	1093	278	4	1394
Number first permanent molars decayed	6	410	415	221	1052	0	210	161	4	375
Number with good oral hygiene	7	131	68	46	252	18	300	179	6	503
Number with fair oral hygiene	28	359	328	147	862	13	78	79	0	170
Number with poor oral hygiene	0	3	6	1	10	0	0	0	0	0

TABLE 8.—DENTAL CONDITION OF CHILDREN HAVING OCCASIONAL HOME CARE

	Group 1					Group 2				
Grades	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Number examined	83	622	757	273	1735		67	58		125
Number cavities	341	2632	1821	876	5670		267	56		323
Number first permanent molars decayed	7	494	980	382	1863		37	39		76
Number with good oral hygiene	6	49	24	1	80		38	36		74
Number with fair oral hygiene	71	557	712	271	1611		29	22		51
Number with poor oral hygiene	6	16	21	1	44		0	0		0

dairy farming community and these children have been cared for, for the past thirty years, by one of the local dentists of Belleville at no charge to the orphanage. This dentist sets aside every Friday morning, at which time a certain number of children are brought to his office. He plans to attend to each child twice a

educational work and the remaining half to clinical work.

The Rhobotham chart was used during the examination of the upper four grades and high school in Group 1, but the record of feeding in infancy was obtained only from parents. In the kindergarten and lower four grades of this group, the

chart was used only when parents were present.

In Group 2, the record of feeding in infancy, diseases, sunbaths or ingestion of an excess of sweets was not considered.

In Group 2, it was impossible to have the mothers present during the examinations. The school dentist and school nurse assisted with the information. Fifty-one and eight-tenths plus per cent were boys and 48.1+ per cent were girls.

In Group 1, 23.5+ per cent of children were free from dental defects, while 89+ per cent needed prophylaxis. From birth to 6 years of age, the children average 3.52+ cavities, with a continual rise in Grades 1-4 to an average of 4.22+

All other procedure and history were recorded the same in both groups.

In Group 1, 42 per cent of the children were examined with the parents present. The remaining 58 per cent were older children. Fifty plus per cent were boys and 49+ per cent were girls.

TABLE 9.—DENTAL CONDITION OF CHILDREN HAVING NO HOME CARE

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Number examined	18	40	57	11	126		5	1		6
Number cavities	38	157	173	43	411		9	4		13
Number first permanent molars decayed	0	23	89	21	133		2	3		5
Number with good oral hygiene	0	0	0	0	0		0	0		0
Number with fair oral hygiene	11	40	35	7	93		4	1		5
Number with poor oral hygiene	7	0	22	4	33		1	0		1

TABLE 10.—FINDINGS IN CHILDREN WITH GOOD ORAL HYGIENE

		Group 1					Group 2				
Grades		Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Number examined		13	177	81	52	323	18	338	215	6	577
Number cavities		16	497	100	100	713	2	993	197	4	1196
Number first permanent molars decayed		2	101	51	43	197	0	169	135	4	308
Dietary history	Milk	11	170	75	44	300	18	338	215	6	577
	Fruits	13	171	78	45	307	18	338	215	6	577
	Vegetables	13	171	78	44	306	18	338	215	6	577
	Whole grains	12	158	65	32	267	18	338	215	6	577
	Meat, eggs	12	175	75	45	307	18	338	215	6	577
	Coarse foods	11	163	69	42	285	18	338	215	6	577
	Sunbaths	3	44	6	4	57	0	0	0	0	0
	Vitamin D	10	106	31	17	164	18	126	33	0	177
	Excess of sweets	1	12	4	0	17	0	0	0	0	0

cavities per child. In Grades 5 to 8, there is a considerable decline in the number of cavities, to 2.31+ per child. This, no doubt, is due to the second dentition, which occurs during this period. In the high school group, we find an increase in the prevalence of decay, as these children averaged 3.13+ per child. The general average of this group is 3.24+ cavities per child.

In Group 2, 35+ per cent of children were free from dental defects, while 28 per cent needed prophylaxis. The prevalence of decay in this group is much below that of Group 1 in all age groups, with a general average of 2.15+, or 1.09+ cavities per child less than Group 1. From this information, then, we can more readily appreciate the ages and groups in which dental caries is more

TABLE 11.—FINDINGS IN CHILDREN HAVING FAIR ORAL HYGIENE

		Group 1					Group 2				
	Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
	Number examined	117	949	1079	420	2565	13	111	102		226
	Number cavities	443	4194	2579	1333	8549	17	383	141		541
	Number first permanent molars decayed	11	762	1347	569	2689	0	79	75		154
Dietary history	Milk	113	785	956	387	2241	13	111	102		226
	Fruits	111	786	1002	389	2288	13	111	102		226
	Vegetables	110	771	985	399	2265	13	111	102		226
	Whole grains	107	758	869	264	1998	13	111	102		226
	Meat, eggs	110	771	862	384	2127	13	111	102		226
	Coarse foods	99	660	754	361	1874	13	111	102		226
	Sunbaths	17	132	49	24	222	0	0	0		0
	Vitamin D	65	355	422	97	939	13	24	24		61
	Excess of sweets	5	69	63	26	163	0	0	0		0

TABLE 12.—FINDINGS IN CHILDREN WITH POOR ORAL HYGIENE

		Group 1					Group 2				
	Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
	Number examined	6	29	56	6	97		1			1
	Number cavities	21	192	135	15	363		2			2
	Number first permanent molars decayed	0	64	86	12	162		1			1
Dietary history	Milk	5	27	44	5	81		1			1
	Fruits	6	29	42	6	83		1			1
	Vegetables	6	28	42	6	82		1			1
	Whole grains	5	28	40	4	77		1			1
	Meat, eggs	6	27	34	6	73		1			1
	Coarse foods	6	23	29	5	63		1			1
	Sunbaths	0	13	9	0	22					
	Vitamin D	1	8	13	2	24					
	Excess of sweets	0	4	3	1	8					

prevalent and consequently can concentrate during these ages and in these groups in order to contribute to the control of caries.

Therefore, if a program cannot include all school children in a certain school, it should be stressed in the following groups or grades:

Preschool Group.—This, of course, is the logical place to begin dental health education, as we realize from these figures that the early period of a child's life, as some psychologists say, "the period of dawning intelligence," is the time to teach good dental health habits, as that is the time when habits may be formed which all later education may not wholly erase. We are sure that if the proper health habits were taught during the preschool period, a great reduction of cavities in later life would result.

First or Second Grade.—By examining the first grade pupils, the dentists have an opportunity to urge corrections, thus giving the child a chance to begin his educational career in good health. In the second grade, the dentists will have an opportunity to save more first permanent molars.

Fourth or Fifth Grade.—Examinations in these grades will give the dentists an opportunity to examine the second teeth as they erupt for defects or flaws; which will do a great deal in preventing cavities later in the child's life.

Eighth Grade.—Examinations in this grade give the dentists an opportunity to impress on the child the necessity of en-

TABLE 13.—DIETARY HISTORY

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Milk	129	1089	1075	437	2730	31	450	317	6	804
Fruits	134	1097	1122	440	2793	31	450	317	6	804
Vegetables	134	1078	1105	447	2764	31	450	317	6	804
Whole grains	120	987	974	302	2383	31	450	317	6	804
Meat, eggs	132	1079	991	434	2636	31	450	317	6	804
Coarse foods	105	946	852	403	2306	31	350	317	6	804
Sunbaths	20	189	64	28	301	0	0	0	0	0
Vitamin D	76	469	466	116	1127	31	151	101	0	283
Number cavities	225	2117	1052	351	3745	19	522	84	0	625
Excess of sweets	6	85	70	27	188	0	0	0	0	0
Number cavities	25	492	209	117	843	0	0	0	0	0

TABLE 14.—TEMPERAMENT

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Phlegmatic	1	64	72	35	172	0	18	9	0	27
Number cavities	6	298	190	144	638	0	45	9	0	54
Normal	127	866	1002	393	2388	29	403	290	6	728
Nervous	8	225	142	50	425	2	29	25	0	56
Number cavities	28	901	368	150	1447	6	65	31	0	102

tering high school with a healthy mouth.

The degrees of cavities in both groups were reckoned in the following manner: If the explorer caught in a small external aperture in the enamel, or if it sank below the surface of the enamel, but did not enter the dentin, it was classed as Degree 1. (A greater majority of this class were defects in the enamel.) If the explorer entered the soft dentin or the dentin was exposed, it was classed as Degree 2, and if the tooth was badly broken down or the pulp exposed, it was classed as Degree 3.

In Group 1, 16 per cent have regular dental care and average 2.51+ cavities per child, with 0.75+ first permanent molars defective. Thirty-two per cent are free from dental defects; 60+ per cent have regular, 38+ per cent, occasional and 1+ per cent, no home care. Twenty-three plus per cent have good; 74+ per cent, fair and 1+ per cent, poor oral hygiene. Ninety-five plus per cent include milk in their daily diet; 95+ per cent, fruits; 94+ per cent, vegetables; 83+ per cent, whole grains; 94+ per cent, meat and eggs; 86+ per cent, coarse foods; 52 per cent, vitamin D and 6+ per cent, an excess of sweets. Fourteen per cent have sunbaths.

In Group 2, 76 per cent have regular dental care and average 2.10+ cavities per child, with 0.52+ per cent first permanent molars defective. Thirty-nine plus per cent were free from dental defects; 90+ per cent have regular, 8+ per cent, occasional and 0.03+ per cent, no home care. Seventy-two plus per cent have good, 27+ per cent, fair, and none poor oral hygiene. One hundred per cent include milk in their daily diet, 100 per cent, fruits, 100 per cent, vegetables, 100 per cent, whole grains, 100 per cent, meat and eggs, 100 per cent, coarse foods and 34+ per cent, vitamin D.

Comparison: Sixty plus per cent more

TABLE 15.—HABITS

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Thumb sucking	9	25	17	7	58	1	1	1	0	3
Finger sucking	0	6	1	1	8					
Mouth breathing	1	10	2	1	14					
Lip biting	0	3	1	0	4					

TABLE 16.—OCCLUSION

	Group 1					Group 2				
Grades	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total	Kinder-garten	Grades 1–4	Grades 5–8	High School	Total
Upper protrusion	10	35	20	8	73	0	2	2	0	4
Lower protrusion	0	2	0	0	2	0	0	0	0	0
Lower retrusion	0	2	0	0	2	0	0	0	0	0
Cross bite	1	3	1	0	5	0	0	0	0	0
Open bite	4	17	8	2	31	1	0	0	0	1
Over bite	3	4	3	3	13	1	0	0	0	1
Irregular	0	8	16	0	24	0	0	0	0	0
End to end	0	0	0	0	0	0	0	0	0	0

children in Group 2 have regular dental care and average 0.41+ less cavities per child, with 0.23+ less defective first permanent molars. Seven plus per cent more children in Group 2 were free from dental defects. Thirty plus per cent more in Group 2 have regular home care; while 30+ per cent in Group 1 have occasional home care, and 0.97+ per cent more in Group 1 have no home care. Forty-nine plus per cent more in Group 2 have good oral hygiene, 47+ per cent more in Group 1 have fair, and 1+ per cent poor oral hygiene. Five per cent more children in Group 2 include milk in their daily diet, 5 per cent, more fruit, 6 per cent, more vegetables, 17 per cent, whole grains, 6 per cent, meat and eggs, 14 per cent, more coarse foods; while 18+ per cent more children in Group 1 have vitamin D.

In Group 1, 44 per cent of this group have occasional dental care and average 3.29+ cavities per child, with 1.22+ six-year molars defective. Sixteen plus per cent were free from dental defects; 34+ per cent have regular, 62+ per cent, occasional, and 2+ per cent, no home care. Eight plus per cent have good, 88+ per cent, fair and 3+ per cent, poor oral hygiene. Eighty-eight plus per cent include milk in their daily diet, 90+ per cent, fruit, 88+ per cent, vegetables, 75+ per cent, whole grains, 86+ per cent, meat and eggs, 73+ per cent, coarse foods, 37+ per cent, vitamin D, and 6+ per cent, an excess of sweets. Eight plus per cent have sunbaths.

In Group 2, 17+ per cent have occasional dental care and average 2.52+ cavities per child, with 0.86+ first permanent molars defective. Thirty plus per cent were free from dental defects; 65+ per cent have regular, 33+ per cent, occasional and 1.3+ per cent, no home care. Seventy plus per cent have good, 29+ per cent, fair and none, poor oral hygiene. One hundred per cent of these

TABLE 17.—EFFECT OF THUMB SUCKING ON OCCLUSION

	Group 1					Group 2				
Grades	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Thumb sucking	9	25	17	7	58	1	1	1	0	3
Upper protrusion	9	24	17	7	57	1	1	1	0	3
Open bite	7	13	9	5	34	1	0	0	0	1
Over bite	3	2	1	0	6	0	0	0	0	0

TABLE 18.—SCHOOL PROGRESS

	Group 1					Group 2				
Grades	Kindergarten	Grades 1–4	Grades 5–8	High School	Total	Kindergarten	Grades 1–4	Grades 5–8	High School	Total
Number retarded students	0	101	89	24	214	0	41	11	0	52
Number cavities	0	472	259	117	848	0	119	15	0	134
Number poor students	2	132	129	74	337	0	20	30	0	50
Number cavities	8	552	322	212	1094	0	53	43	0	96

children include milk in their daily diet; 100 per cent, fruit, 100 per cent, vegetables, 100 per cent, whole grains, 100 per cent, meat and eggs, 100 per cent, coarse foods and 37+ per cent, vitamin D.

Comparison: Twenty-seven plus per cent more children in Group 1 have occasional dental care than in Group 2. The children in Group 2 average 0.77 less cavities per child than in Group 1, with 0.36 less defective first permanent molars. Fourteen per cent more of the children in Group 2 are free from dental defects than in Group 1. Thirty-one per cent more of the children in Group 2 have regular home care; 29 per cent more children in Group 1 have occasional home care than in Group 2; 0.7 per cent more children in Group 1 have no home care than in Group 2. Sixty-two per cent more children in Group 2 have good oral hygiene; 59 per cent more children in Group 1 have fair oral hygiene. Three per cent more children in Group 1 have poor oral hygiene. Twelve per cent more children in Group 2 include milk in their daily diet; 10 per cent, more fruit, 12 per cent, vegetables, 25 per cent, whole grains, 14 per cent, meat and eggs and 27 per cent, coarse foods.

A majority of these children have only been to the dentist once in their life and then to have a tooth extracted.

In Group 1, 38+ per cent have no dental care and average 3.53+ cavities per child, with 0.96+ first permanent molars defective. Twenty-four plus per cent were free from dental defects; 30+ per cent have regular, 62+ per cent occasional and 6+ per cent no home care; 7+ per cent have good, 88+ per cent fair and 4+ per cent poor oral hygiene. Ninety-one plus per cent include milk in their daily diet, 94+ per cent, fruits, 93+ per cent, vegetables, 81+ per cent, whole grains, 84+ per cent, meat and eggs, 76+ per cent, coarse foods, 31+ per cent, vitamin D and 6+ per cent, an excess of sweets. Ten plus per cent have sunbaths.

In Group 2, 5.9+ per cent have no dental care and average 1.83+ cavities per child, with 0.37+ first permanent molars defective. Thirty-three plus per cent were free from dental defects; 52+ per cent have regular, 41+ per cent occasional and 6+ per cent no home care; 50+ per cent good, 47+ per cent fair and 2+ per cent poor oral hygiene. One hundred per cent of these children include milk in their daily diet, 100 per cent, fruits, 100 per cent, vegetables, 100 per cent, whole grains, 84+ per cent, meat and eggs, 100 per cent, coarse foods and 29+ per cent, vitamin D.

Comparison: Thirty-two plus per cent more of Group 1 than Group 2 have no dental care. Group 2 average 1.7+ less cavities per child, with 0.59+ less defective first permanent molars. Nine plus per cent more children in Group 2 were free from dental defects; 22+ per cent more in Group 2 have regular home care and 21+ per cent occasional; 43+ per cent more in Group 2 have good oral hygiene, while 41+ per cent more children in Group 1 have fair oral hygiene; 2+ per cent more children in Group 1 have poor oral hygiene. Nine plus per cent more children in Group 2 take milk, 6+ per cent, fruits, 7+ per cent, vegetables, 19+ per cent, whole grains, 16+ per cent, meat and eggs, 24+ per cent, coarse foods, and 2+ per cent more children in Group 1 receive vitamin D.

In Group 1, 37+ per cent have regular home care and average 3.15+ cavities per child, with 0.93+ defective first permanent molars. Twenty-two plus per cent have good oral hygiene, 76+ per cent fair and 0.8+ per cent poor.

In Group 2, 83+ per cent have regular home care and average 2.07+ cavities

per child, with 0.55+ defective first permanent molars. Seventy-four plus per cent have good, 25+ per cent fair and none poor oral hygiene.

Comparison: Forty-six plus per cent more children in Group 2 have regular home care and average 1.08+ cavities per child less, with 0.38+ less defective first permanent molars. Fifty-two plus per cent more children in Group 2 have good oral hygiene; 51+ per cent more children in Group 1 have fair oral hygiene, and 0.8+ per cent more children in Group 1 have poor oral hygiene.

In Group 1, 58+ per cent have occasional home care and average 3.26+ cavities per child with 1.07+ defective first permanent molars. Four and six-tenths plus per cent have good, 92+ per cent fair and 2+ per cent poor oral hygiene.

In Group 2, 15+ per cent have occasional home care and average 2.58+ cavities per child, with 0.6+ defective first permanent molars. Fifty-nine plus per cent have good and 40+ per cent fair oral hygiene.

Comparison: Forty-three plus per cent more children in Group 1 than in Group 2 have occasional home care. Children in Group 2 average 0.68+ less cavities per child, with 0.47+ less defective first permanent molars. Fifty-five plus per cent more in Group 2 have good oral hygiene, 52+ per cent more children in Group 1 have fair oral hygiene and 2+ per cent more children in Group 1 have poor oral hygiene.

A majority of these children brush their teeth on the average about once a week.

In Group 1, 4.2+ per cent have no home care and average 3.26+ cavities per child, with 1.05+ defective first permanent molars. None have good, 73+ per cent fair and 26+ per cent poor oral hygiene.

In Group 2, 0.07+ per cent have no home care and average 2.16+ cavities per child, with 0.83+ defective first permanent molars. Eighty-three plus per cent have fair and 16+ per cent poor oral hygiene.

Comparison: Four and thirteen-hundredths plus per cent more children in Group 1 have no home care. The children in Group 2 average 1.10+ less cavities, with 0.22+ less defective first permanent molars. Ten per cent more children in Group 2 have fair oral hygiene and 10 per cent more children in Group 1 have poor oral hygiene.

In Group 1, 10.8+ per cent have good oral hygiene and average 2.20+ cavities per child, with 0.6+ defective first permanent molars. Ninety-two plus per cent of these children include milk in their daily diet, 95+ per cent fruit, 94+ per cent, vegetables, 82+ per cent, whole grains, 95+ per cent meat and eggs, 88+ per cent, coarse foods, 50+ per cent, vitamin D and 5+ per cent an excess of sweets. Seventeen plus per cent have sunbaths.

In Group 2, 71+ per cent have good oral hygiene and average 2.07+ cavities per child, with 0.53+ defective first permanent molars. One hundred per cent of these children include in their daily diet milk, fruits, vegetables, whole grains, meat and eggs and coarse foods, and 30+ per cent receive vitamin D.

Comparison: Sixty-one plus per cent more children in Group 2 have good oral hygiene and average 0.13+ less cavities with 0.07+ less defective first permanent molars. Eight plus per cent more children in Group 2 include milk in their daily diet, 5+ per cent, fruits, 6+ per cent, vegetables, 18+ per cent, whole grains, 5+ per cent, meat and eggs, 12+ per cent coarse foods, while 20+ per cent more children in Group 1 have vitamin D.

In Group 1, 85+ per cent have fair

oral hygiene and average 3.33+ cavities per child, with 1+ defective first permanent molars. Eighty-seven plus per cent include milk in their daily diet, 89+ per cent, fruits, 88+ per cent, vegetables, 77+ per cent, whole grains, 82+ per cent, meat and eggs, 73+ per cent, coarse foods, 36+ per cent, vitamin D and 6+ per cent an excess of sweets. Eight plus per cent have sunbaths.

In Group 2, 28+ per cent have fair oral hygiene and average 2.39+ cavities per child, with 0.68+ defective first permanent molars. One hundred per cent of these children include in their daily diet milk, fruits, vegetables, whole grains, meat and eggs and coarse foods, and 26+ per cent receive vitamin D.

Comparison: Fifty-seven plus per cent more children in Group 1 have fair oral hygiene. The children in Group 2 average 0.94+ less cavities per child, with 0.32+ less defective first permanent molars. Thirteen plus per cent more children in Group 2 include milk in their daily diet, 11+ per cent, fruits, 12+ per cent, vegetables, 23+ per cent, whole grains, 18+ per cent, meat and eggs and 27+ per cent, coarse foods; while 10+ per cent more children in Group 1 receive vitamin D.

In Group 1, 3+ per cent have poor oral hygiene and average 3.74+ cavities per child, with 1.67+ defective first permanent molars. Eighty-three plus per cent include milk in their daily diet, 85+ per cent, fruits, 84+ per cent, vegetables, 79+ per cent, whole grains, 75+ per cent, meat and eggs, 64+ per cent, coarse foods, 24+ per cent, vitamin D and 8+ per cent, an excess of sweets. Twenty-two plus per cent have sunbaths.

In Group 2, 0.01+ per cent have poor oral hygiene and average 2 cavities per child with 1 defective first permanent molar. One hundred per cent include in their daily diet milk, fruits, vegetables, whole grains, meat and eggs and coarse foods.

Comparison: Two and nine-tenths plus per cent less children in Group 2 have poor oral hygiene and average 1.74+ less cavities per child, with 0.67+ less defective first permanent molars. Seventeen plus per cent more children in Group 2 include milk in their daily diet, 15+ per cent more, fruits, 16+ per cent more, vegetables, 21+ per cent more, whole grains, 25+ per cent more, meat and eggs and 36+ per cent more, coarse foods; while 24+ per cent more children in Group 1 receive vitamin D.

In Group 1, 91+ per cent include milk in their daily diet, 93+ per cent, fruits, 92+ per cent, vegetables, 79+ per cent, whole grains, 88+ per cent, meat and eggs, 77+ per cent, coarse foods, 37+ per cent, vitamin D and 6+ per cent, an excess of sweets. Ten plus per cent have sunbaths. The 1,127 children taking cod-liver oil average 3.32+ cavities per child. The 188 children having an excess of sweets average 4.48+ cavities per child.

In Group 2, 100 per cent include in their daily diet milk, fruits, vegetables, whole grains, meat and eggs and coarse foods, and 35+ per cent receive vitamin D. The 283 children taking cod-liver oil average 2.20+ cavities per child.

Comparison: Nine plus per cent more children in Group 2 include milk in their daily diet, 7+ per cent, fruits, 8+ per cent, vegetables, 21+ per cent, whole grains, 12+ per cent, meat and eggs and 23+ per cent, coarse foods; while 2+ per cent more children in Group 1 have cod-liver oil. The children in Group 2 taking cod-liver oil average 1.12+ less cavities.

In Group 1, 172 phlegmatic children average 3.70+ cavities per child. The 425 nervous children average 3.40+ cavities per child.

In Group 2, the twenty-seven phleg-

matic children average 2 cavities per child. The fifty-six nervous children average 1.82+ cavities per child.

Comparison: The phlegmatic children in Group 2 average 1.70+ less cavities and the nervous children in Group 2 average 1.58+ less cavities per child.

In Group 1, 1.9+ per cent were thumb suckers; while in Group 2, only 0.03+ per cent were thumb suckers.

In Group 1, 214 retarded children average 3.96+ cavities per child and 337 poor students average 3.24+ cavities per child.

In Group 2, fifty-two retarded children average 2.57+ cavities per child and fifty poor students average 1.92+ cavities per child.

Comparison: The retarded children in Group 1 average 0.72+ more cavities than the general average; while the children with poor scholastic standing in Group 1 average the same as the general average. The retarded children in Group 2 average 0.42+ more cavities than the general average of that group; while the students with poor scholastic standing average 0.23+ less cavities than the general average of the group.

CONCLUSION

From this report, we are justified in saying that a dental health educational program conducted strictly along educational lines, under the supervision of the dental profession, will be a great benefit to the children and parents in arousing a desire for better teeth. It will also tend to raise the health standard, as far as dental health is concerned, by improving home care, dental care and the diet, and thus reducing the prevalence of decay.

DISCUSSION

Guy S. Millberry, San Francisco, Calif.: Dr. Deatherage's study is comparable to similar investigations carried on in other parts of this country and in other countries. The technic used in gathering the data is not unlike the general procedure followed in making such surveys and the resuts obtained conform to the averages customarily found. It is impossible to discuss the statistical data. One rarely remembers the figures which are quoted and they have value only when comparisons are made with subsequent surveys in the same school or district; other factors in another place may modify the results. Dr. Deatherage states that he has used the Rhobotham charts for his record forms. These are recommended for members of the profession engaged in children's practice and for divisions of children's dentistry in colleges. While I appreciate the many valuable contributions Dr. Rhobotham made to the practice of children's dentistry during his lifetime and the sincerity with which he carried on his work, I believe the charts designated as the Rhobotham charts do not provide enough space for the data required in a complete medical, dental and nutritional examination of the child. Some of the information sought seems to me to be superfluous and the value of certain items is questioned by many authorities. For example, in the physical history, the height of the child is recorded and beneath that the normal weight. The height-weight ratio, as a standard of nutrition, was discarded by the leading investigators in child hygiene a number of years ago, because it is undependable, and a new formula, known as the A.C.H. index, has been generally accepted. Arm circumference at the biceps, chest depth anteroposteriorly, measured by calipers, and the height are the measurements used in this formula. These were accepted after thorough study by the American Child Hygiene Association and are widely employed. Then there are nine diseases listed, with space for recording the age of the child at the time he suffered from them. At best, this age period is a guess with most mothers, unless the occurrence has been recent; and even if it were accurate, what value does this have for the dentist? We were taught in the past that cases of hypoplasia were probably due to some one of the exanthems, and because there was reason

to believe that this might be true, we accepted this cause as the only one. Recent research in nutrition leads us to believe that dietary deficiencies, prevailing at the time these skin diseases existed or at some other time, may have been the cause of hypoplasia, or at least a contributing factor. Again, there is the dietary history, giving a list of foods, and sun baths taken, with a space for checking one each year for eight school years Today, the nutritionist wants to know what the child eats each day and how much of each necessary element of diet he has eaten each day, in order to determine whether dietary deficiencies contribute to his state of health. Since the cells of the body require certain nutritient elements every day—yes, every moment of the day—in order to perform their functions, it is easily seen that a casual inquiry once a year as to the dietary habits of the child will elicit no information of value. It seems to me that we are too prone to make examinations of the mouths of school children and others, especially since the depression began, with the thought that by doing so and referring the examined child to a dentist for treatment, the problem of dental disease will be solved. A committee of the American Child Health Association, working under a grant from the Metropolitan Insurance Company, made a study of this procedure recently. The report was published in 1934, under the title, "Physical Defects: The Pathway to Correction." The study included defects of vision, the teeth, hearing, nutrition; also school health influence on tonsillectomy and the control of pediculosis. The purpose of the study was "to help to point the way to more effective health programs in the schools of our country." The results of the committee's efforts, as presented in this report, are quite clearly expressed as follows: "So intent has been the effort in getting the examination procedure established that the utilization of the findings of the examination has been quite overshadowed. The inability to follow up adequately the indications of the examination for such large numbers of children has resulted in the accumulation of extensive records of physical defects which continue to remain as such, uncorrected and unattended. The chief purpose of the examination—medical attention and relief for the adverse condition revealed—was often not attained." I believe this gives a true picture of the efforts so frequently made by dentists and dental societies in their endeavor to promote the practice of dentistry by inviting or encouraging children or others to see their dentists for professional services. Please do not misconstrue this to be an objection to the plan of recommending dental service when needed. This, I think, is necessary and I always advocate it. But if getting people to have all required dental service done is to be the goal in the prevention of dental disease, especially for children, it will never be approached, let alone reached, for there are not enough dentists in the United States, even if they were employed full time in their offices all the year round, to render all the reparative and corrective service for the children enrolled in our schools and colleges in this country. I cannot agree with Dr. Deatherage when he says in his summary that surveying the defective teeth of school children in any locality and referring those pupils with defective teeth to a dentist, with casual advice on home care and diet, will benefit the children or parents very much or reduce the prevalence of decay; nor do I think that the Illinois plan differs materially from hundreds of plans that have been used during the past decade. We must institute a daily dental health program in the home that will maintain the necessary standard of health for the conservation of the teeth and a plan of dietary control that will provide the essentials for building good teeth, as well as a system of health education in the schools that is comparable to, if not better than, our present system of training for mental growth and attainment, if we would prevent dental disease.

DENTISTRY IN A PUBLIC HEALTH PROGRAM

By ERNEST A. BRANCH,* D.D.S.

PRACTICALLY every known avenue of public health growth and development has been utilized save that particular field that the dentist specializes in, mouth health.

Public health is the aggregate of individual health. As long as the individual's health is confined to the individual over the river, we allow him to do as all of our friends who live over the river have done—the best he can. But when individual health is taken collectively and influences the health of others, it becomes a problem of the whole and is termed public health. When the public's health affects us economically or socially or in terms of our physical well-being, we take notice, and become vitally concerned. Public health has to do with two groups of diseases, communicable and degenerative.

COMMUNICABLE DISEASES

Communicable diseases, which the lay public calls "catching," have been appreciably reduced within the recollection of the present generation. Some of us recall that, as surely as summer came, we had an epidemic of typhoid fever. A physician in one of the eastern counties in North Carolina recalled recently that there was a time in his practice when he had as many as fifty cases of typhoid fever within a summer. "But," said he, "there were only five cases of typhoid fever in my county last year." He attributed this great dropping off of typhoid cases to improved sanitation and to the wide usage of immunization against typhoid fever. He went on to say that the demand on the part of the public for immunization is brought about by spreading of the knowledge of prevention through the educational program of the state board of health. The testimony from this physician could be duplicated in practically every county in the state.

Another disease of the communicable type which a few years ago was rampant from one end of the state to the other, taking a tremendous toll among the young children is today called diphtheria, but was in the early days, in certain sections, known as the strangler. In those days, when a child was discovered to have diphtheria, the parents immediately took steps to send the other children in the family to the homes of relatives without children, there to remain until the sick child either died or got well, and usually the child died. This method of isolation was the only means of prevention known at that time. Today, we have few cases of diphtheria and practically no deaths from it, owing to the fact that the public is educated to modern means of prevention, and parents demand that their children be protected against diphtheria before 6 months of age by the use of toxoid. In our present-day civilization, thanks to wide-spread education along the lines of prevention, all communicable diseases are on the decrease.

DEGENERATIVE DISEASES

This is not true of degenerative dis-

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eases; i. e., diseases of the heart, kidneys and lungs. If we were talking to a group of 12-year-old boys and used the term degenerative, they would immediately associate the word with the generator of the automobile, and any boy of that age could tell you what the generator of an automobile is, and what it does. He would tell you that it charges the battery and really keeps the automobile alive and going. If we go down the street in the morning and inquire of those we meet as to how they feel, we frequently get the reply, especially if they are beyond middle-age, "I am just dragging along," a gesture indicating a depleted, fagged out condition. The boys' association of degenerative without generator is not far wrong. Most of the degenerative diseases begin in childhood. We are told by the medical profession that practically all degenerative diseases enter the body by way of the mouth and nose. The mouth is the dentist's field. In our work with children, we may rule out many sources of infection that we have to deal with in adults. The prostate or ovaries of children have not functioned, the gallbladder seldom gives trouble, an appendicitis is usually acute rather than chronic, colitis is more often acute than chronic, etc.; but the mouth is a vital field for consideration.

A prominent pediatrician has said that most of the glandular tuberculosis of children originates in the mouth. He points out that a mouth of broken down, abscessed teeth is a perfect incubator for the propagation of bacteria. When there are broken down teeth, in the mouth, where it is dark, moist and warm, we have all the culture mediums needed for the growth of *Mycobacterium tuberculosis*. The child's tonsils are a fertile source of infection, and inflamed and enlarged tonsils usually follow diseased teeth. Think of the infection possible in a mouth that is perfectly filthy from lack of care and is filled with "gum boils," which, when they rupture discharge into the mouth, the discharge mixing with the food and being swallowed. I have not mentioned the infection spread by the blood stream from the root ends of the teeth to the kidneys, to be filtered out with other poisons and water from the blood.

In going into the schools today, we find, in the first, second and third grades, more children with heart, kidney and lung affections than we have ever known before. We also find more children with decayed teeth. Scarlet fever, which is responsible for many kidney lesions in children, is, from the morbidity reports, more or less rare.

Reduction of the incidence of degenerative diseases is the big problem of public health today. The reduction of infection in the mouth, which is the dentist's field, is the dentist's responsibility.

In certain states, as many as one third of the children enrolled in the schools are repeating their grades. This tremondous economic drain on the school budgets is due to irregular attendance, it is said, but the poor attendance record, in almost every case, is due to the unhealthy environment in which the child lives, and to his own bodily ills. The child is listless and inattentive and does not remember the lesson, some say, while still others say that he presents a behavior problem. I admit all this, but, in addition, the child is sick from the infection outlined above. The child in this physical condition is going to continue repeating grade after grade as many others have done and are doing. The child will also continue to develop a sense of inferiority and will become a behavior problem, be caught up in the juvenile courts, be placed in a reformatory or penal institu-

tion, and, later, be on a relief roll. This child is a social misfit and an economic liability.

Do you suggest an ounce of prevention? Now is the time it is needed. Mouth health education supplies this prevention. The dentist is a necessary adjunct to every public health program.

No county health department in North Carolina is rated as a standard or A grade health department unless it has a mouth health program directed by the division of oral hygiene of the state board of health.

DYAK DENTISTRY*

Announcer: Good morning, Doctor. You haven't forgotten, have you, that you were to tell us more about the natives of Borneo this morning, and that you promised to explain something about their custom of filing and coloring their teeth?

Doctor: No, I haven't forgotten, and if you are interested, and if you think our radio audience is interested, I'll be glad to.

Announcer: I *am* interested, Doctor, and I'm sure our audience is interested. Can the present generation of North Borneo natives be classified as head-hunters? Who are the Dyaks? Why do they flatten the heads of infants? Why do they file and color their teeth? How do they manage to obtain such gruesome dental designs? I can think of so many questions about those interesting people that you won't have nearly enough time to answer.

Doctor: All right, all right. The more questions, the more time it will take, and the more time consumed in questions, the less I will have to talk.

Announcer: That's what I'm afraid of, and our audience doesn't want to listen to my questions—they want to hear something about the Borneo head-hunters.

Doctor: Well, ——, British North Borneo has an area of 31,000 square miles. It lies in the northern-most tip of the Island of Borneo, one of the largest of the East Indian Islands, and directly south of China and slightly southwest of the Philippines. It is bisected by the equator. British North Borneo has a mixed population of about 208,000 people, of which 400 or 500 are white. By far the largest percentage of the population are Dyaks.

Announcer: Oh yes, those are the natives whose ancestors, even quite recent ancestors, I believe, were head-hunters.

Doctor: Correct. The Dyaks are beautifully built people, although somewhat short in stature. To all outward appearances, they have fine manners. When a Dyak first meets you, he very courteously inquires about your health, and he is very solicitous about your welfare.

Announcer: At the same time, he is probably coveting your head and wondering how he can acquire it.

Doctor: No doubt; but in the sea ports and villages, in the presence of others, that is, the Dyak is a charming person. He may covet your head, but he contents himself with a liberal helping from your tobacco pouch and leaves you with abundant good wishes and the hope that your rice crop will be exceedingly ample. There is nothing snobbish about the Dyak. He wants you to feel that you are at least his social equal.

*Radio talk.

Announcer: I gather from what you say that when he meets you in company, he is painfully polite. But when he meets you alone, he is apt to be politely painful.

Doctor: Right. And if the solitary meeting is a hurried one, he may even forget his politeness.

Announcer: That's disappointing. Primitive politeness should never be forgotten. By the way, Doctor, didn't I read somewhere that the Dyaks flatten their children's heads? That's a curious custom, isn't it?

Doctor: Yes, a curious but rather common custom and one that is followed by many different people. Certain American Indian tribes carried this practice to the extreme. The government museum at Victoria, B. C., has a large collection of flattened and elongated Indian skulls; so, too, has the Field Museum in Chicago. You might be surprised to know that, until quite recently, in certain provinces in France, it was customary to bind and shape babies' heads until they acquired a most unnatural appearance.

Announcer: That is interesting. I wonder what prompts such a practice.

Doctor: I don't know, except for man's age-old attempt to improve on nature. Why do some American men wear mustaches? Why did our fathers and grandfathers wear beards? Why do American and European women use lipstick, rouge and powder? Why, for instance, do the Dyaks carry a set of tweezers and a bit of looking glass with them at all times and, during their leisure moments, of which they have many, pluck the hair from face and body? Why do they rub quick lime into their skin to kill the hair follicles so that they may be smooth-faced and beardless?

There is no accounting for human tastes; but that has nothing to do with the Dyak head-flattening practice.

Announcer: Do all the Dyaks follow that custom?

Doctor: No, I believe not. One tribe, the Milanous, seem to be the chief advocates of this practice. They consider it a sign of beauty to have a flat forehead and they flatten the heads of most of their girl babies. Some boy babies are treated in the same way. When a child is a few days old, an instrument consisting of an ingenious arrangement of strings is fastened to its head. By tightening the strings, equal pressure is brought to bear on the child's forehead. Gentle, though constant pressure generally produces the desired effect by the time the child is a year old. Apparently, the Dyaks do not carry the practice to an extreme, as their heads are not nearly so misshapen as those of some of our North American Indians or certain Eskimos.

Announcer: I take it the Dyaks are a rather busy tribe. What with their practice of flattening heads, hunting heads, preserving their own heads, removing hair, adorning ears and mutilating teeth, they don't have much time for such prosaic things as work. By the way, how do they file their teeth? You promised to explain that today.

Doctor: So I did—and so I shall, to the best of my ability. The teeth of the Dyaks, like the teeth of most primitive people, are naturally beautifully white and regular; but it is the fashion for the young of both sexes to disfigure the teeth as they approach puberty. The boys especially adopt the practice when they reach the age at which they wish to please the women. They greatly dislike white teeth, because, they say, dogs, and other animals have teeth of that color. Before the advent of the white man, the natives ground their upper front teeth down to sharp points, or, in some instances, they ground them down flat, even to the gums, by means of small pieces of sandstone, or

with wood, water and sand. Since the coming of the white man, the natives have improved somewhat on their technic and they now use, in addition to sand and stone, crude files or saws made of watch springs or other white man's metal.

Announcer: One set of instruments sounds just as painful as the others to me, Doctor. I suppose their medicine men become quite proficient in their practice of Dyak dentistry.

Doctor: Yes, and the operation itself is quite a ceremonial. It is performed by the local "Pawang," or witch doctor, in two or more stages with a few years' interval between each two operations. The Pawang, with many precautions and incantations, places a poultice of herbs on the victim's gums just above the teeth to be operated on. The patient places his head in the concavity of a tree trunk or some other solid substance for support and the Pawang proceeds with his native files to cut v-shaped spaces between the teeth. At subsequent sittings, the teeth may be ground down flat with the gums or further pointed, this depending on the custom of the tribe. Certain of the natives use, in their hunting and fighting, a "sumpitan," or long blowpipe for shooting poison darts. These natives break off the upper front teeth, as they feel that it permits a stronger blast on the blowpipe.

Announcer: I should think grinding the teeth down like that would kill the pulp or nerve and produce abscesses.

Doctor: Apparently it doesn't. Perhaps because the mutilation is done slowly with a few years' interval between each two sessions, the pulps have a chance to recede from the abrasions. They have another tooth custom which may help preserve the pulps: they blacken the teeth by rubbing them with burnt coconut shell pounded up with resin from certain woods. The shells and wood are held over a hot fire until a black resinous juice exudes. This is collected, and, while it is still warm, the teeth are coated with it. The natives assert that this black resinous coating not only beautifies their teeth, but also preserves them.

Announcer: I understand that they chew a great deal of betel nut in Borneo. That also keeps their teeth black, does it not?

Doctor: Chewing of the betel nut is a very common custom among the Dyaks, but, contrary to common belief, this does not turn the teeth black. On the contrary, it tinges the saliva, gums and lips a brilliant red. After years of this practice, the mouth becomes a ghastly gory color. No, the teeth are blackened by a stain composed of the juice of the "pinang" fruit mixed with copper sulfate or a stain from the resinous tar from burnt coconut shells. To the Dyak, white teeth are horrible—black teeth, beautiful.

Announcer: In that case, I'd hate to be a toothpaste salesman detailed to that country. Modern dentifrice advertisements would leave them cold.

Doctor: Very much so, I'm afraid. By the way, these people have another tooth custom that you would be interested in. Many of the Dyaks, both men and women, wear copper and other metal inlays in the teeth, which are pointed or sharpened and have a hole drilled through them by the witch doctor, who then inserts a small copper or brass wire. Sometimes, the ends of the wire are festooned in star shape, making a (to them) very attractive ornament.

Announcer: I have an idea that the technic employed is much more painful than precise.

Doctor: Agreed; but there is no accounting for custom, you know. It wasn't so many years ago in this country that the wearing of a gold crown on a front tooth was considered by many to represent the height of affluence. Now, of course, we

try to restore teeth, especially the front teeth, to their natural color and contour.

Announcer: Yes, thank goodness, we are fortunate to be living in an age of partial understanding anyway; which reminds me: wouldn't it be a good idea to impress on the parents who are listening in this morning that we are not Dyaks or "Borneorians" or whatever you call them? We are Americans, and, as good American parents, we should spend as much time and attention in the preservation of our children's teeth as the heathen Dyak parents do in mutilating theirs.

Doctor: Yes, we should. We would be remiss in our duty if we did not stress that fact. Our American people enjoy the reputation of having better teeth than most of our European cousins; but, between you and me, our teeth are far from perfect. For one thing, we don't pay as much attention to our children's teeth as we should.

I'm afraid that we American parents do not realize the relationship between good teeth and child health. School starts in a very few days. Some schools I believe, have already started. Every American parent owes it to his children to see that their mouths and teeth are free from infection so that they can carry on their school work unhampered by toothache, abscesses, or gum boils and other dental disease.

Announcer: Thank you, Doctor. I believe we Americans are rapidly realizing that fact. In a few generations, it will be just as customary for people to insist that their children have healthy teeth as it now is for Dyaks to insist that their children's teeth be blackened and mutilated.

Now before closing, I want to invite you to take full advantage of these short dental health periods. Should you have any questions to ask about the care of your own teeth or about the care of your children's teeth, do not hesitate to send them into this station _____. We will see that they are given prompt and careful attention.[1]

1. Material taken largely from "Natives of Sarawak and British North Borneo," by H. L. Roth, published in London by Truslove and Hanson, and "The Jungle Dentist," by C. L. D. Taylor, D. Mag. & Oral Top., July, 1934.

CURIOUS DENTAL CUSTOMS OF THE DYAKS*

Announcer: I never realized until last week, Doctor, how very closely teeth are interwoven with the history of the human race, and with the customs of mankind. That interesting picture that you painted last Saturday of the rain-making ceremonies of the Australian aborigines aroused my curiosity. In fact, I spent an hour or so Sunday browsing through a few travel books that I have at home. Apparently, most primitive people immortalize teeth. Can you tell us why, Doctor?

Doctor: No, I can't say that I can, _____. It may be that man's deep-rooted desire for immortality; his age-old longing "to dwell in changeless prime of body and of soul"; his relentless search for an elixir of eternal life caused him to reverence teeth as a symbol of that condition.

Announcer: I don't believe I understand you, Doctor. By what stretch of

*Radio talk.

the imagination can teeth be a symbol of eternal life? Judging by the amount of dental work that adorns the mouths of my friends and relatives, I wouldn't select teeth as a symbol of enduring quality: quite the reverse. And I don't say that facetiously either.

Doctor: Unfortunately, ——, your observations are so nearly correct that it is not laughable. But remember, we are not talking about the teeth of modern Americans. We are talking about the teeth of primitive people. Barring accidents, of which there were many, and deliberate mutilations, of which there were more, their teeth were and are the most nearly enduring and permanent organs of the body.

The native learned by experience that the teeth of his own kind and of the animals about him remained intact long after the disintegration of the body. Hence, he probably conjectured, in his primitive way, that teeth were clothed in immortality, that the gods had looked on them with special favor and that they symbolized vitality and enduring life.

Announcer: I see. That is a perfectly logical explanation. Is there any other reason that teeth should play such an important part in the customs of primitive people?

Doctor: Yes. It is easy to suppose that our primitive brothers learned from sad experience that the loss of teeth impaired health and strength. Having lost the teeth, neither man nor animal could eat or fight so well. Also, only weak creatures, such as infants and the aged, had few or no teeth. Powerful animals had powerful teeth, especially powerful tusks. Hence, the canine teeth, or cuspids, were very frequently selected as objects of special worship.

Announcer: Come to think of it, Doctor, almost every picture that I ever saw of primitive people showed them adorned with necklaces and armlets of shells and teeth. The wearing of this type of jewelry is undoubtedly interwoven with their superstitious beliefs. I suppose they value such jewelry very highly.

Doctor: Yes indeed. Among certain tribes, these necklaces or circlets of teeth are worn as an insignia of office, just as the chains of office are worn in more civilized countries by kings, presidents and other high officials.

Announcer: And, I suppose, the higher the tribal office, the more ornate the necklace.

Doctor: That's right. For instance, the Dyaks of British Borneo, off the Sulu Sea, particularly prize jewelry made of animal or human teeth. The Dyaks, you know are head hunters; or at least they were until a comparatively few years ago. When the head-hunting practice was common, ornate necklaces and breastplates of human teeth were very popular. In more recent years, the Dyaks have contented themselves with ornaments of animal teeth.

Announcer: And, I suppose, mutilate their lips, nose, and ears with bone and metal rings and bangles.

Doctor: The Dyaks don't wear the nose or lip ornaments that are so popular among some East Indian tribes. They do wear earrings of enormous size. The parents pierce the ear lobes of their 2 and 3 year old children, and, especially in the case of the girls, they hang heavy weights from wires or string inserted through these holes. As the girls grow larger, the weights are increased, until, it is said, in some instances, the opening in the elongated ear lobes becomes as large as the girl's head. Returned travelers report that some young women have as much as a 2-pound weight suspended from each ear. Naturally, ear ornaments of such size interfere with the activity of the

wearer. The men wear earrings that are not so burdensome. The lobes of their ears seldom hang down more than 2 inches.

Announcer: An article that I read the other night mentioned something about the Dyaks. They are very interesting people. The Sea Dyaks, I recall, are especially ferocious.

Doctor: Yes, much more so than their inland brothers, the Land Dyaks; although I wouldn't care to meet a member of either tribe in the dark. They still look with favor on their near ancestors' head-hunting customs, although their Big British brothers have discouraged the practice.

Announcer: Playful practice, to say the least.

Doctor: Isn't it? Most of the Dyak males adorn their bodies with teeth jewelry. Some of the neck pieces are especially ornate, and, according to native belief, they give the owner and wearer the strength and courage of the animal from which the teeth were procured. Some of the necklaces are surprisingly intricate in design. One type consists of from one to four rows of beads, next a row of small shells, and then a wide outer circle or row of wild boar or bear tusks. Wild boar tusks are highly prized because of the supposed strength, cunning and courage that they give the wearer. Bear tusks are similarly esteemed and for the same reason. These tusks are valued by the natives at 2 rupees at least, or about 65 cents each. You can readily realize that when a necklace contains from 30 to 40 tusks, it is a rather expensive ornament. Only the head men can afford them. The poor must content themselves with less expensive spangles. Certain of the more influential natives wear necklaces of the tiger's teeth. These are fastened by their roots to a brass wire in such manner that the sharp pointed cusps radiate outward in a wide circle and present a very formidable defense for the breast of the wearer. Charms are attributed to most necklaces of this type, and they are prized not only for their intrinsic worth, but also because of the fact that they imbue the owner with wild animal courage.

Announcer: Do the Dyaks, like the Australian aborigines, mutilate the teeth of their young?

Doctor: Not in the same manner. You recall that the aborigines knocked out the upper front teeth of their boys at puberty. You also recall that they knocked out the upper front teeth of certain girls as well as certain boys during their rain-making ceremonies. The Dyaks of North Borneo do not follow that custom, although they do mutilate their teeth by filing, chipping and coloring.

Announcer: How do they do that? It would seem to me that the pain would be unbearable. They must have only the crudest instruments to work with. No anesthetics, no sedatives. It seems to me that the slow, tedious filing and chipping would be even more torturous than knocking the teeth out.

Doctor: Suppose we answer your questions next week, _____. I see that our time is almost up today, and I would rather not take up that subject unless I have time to finish it.

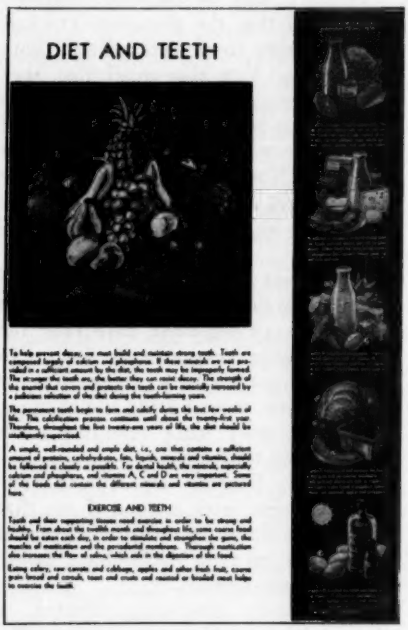
Announcer: I'm sorry, Doctor. I didn't notice our time was so short. Before signing off, I can't help but compare the superstitious beliefs of the Dyaks with the scientific knowledge of twentieth century Americans. Tribal tradition teaches the Dyaks that the possession of tiger teeth gives the possessor additional strength and courage. Dental and medical science has taught modern Americans that the possession of a full complement of sound healthy teeth does aid materially

in giving the owner additional strength, health, and beauty.

Should any one listening in this morning have a question regarding the care of the teeth, if it is sent to this station, WBBM, we will see that it receives an immediate answer.[1]

Dental Health Education Charts

The new dental health charts recently announced by the Bureau of Public Relations are meeting with instant approval from every one who sees them. Orders are pouring in from all parts of the country.



Dental health education chart.

There are eight charts in the set. Each chart, 22 by 29 inches, is illustrated with one large and five small artistic and accurate paintings. The illustrations are done in five colors. The text is concise and to the point. The charts are bound at the top with modern spiral binding.

The following eight subjects are covered: the teeth; the deciduous teeth; the permanent teeth; diet and teeth; dental care; mouth hygiene; preventing decay in the deciduous teeth; preventing decay in the permanent teeth.

These charts are so designed that they can be used successfully by the dentist in his office or by dental health workers in junior or senior high schools or normal schools; or to illustrate lectures before any adult group.

It is suggested that the members of component dental societies pool their orders and thus take advantage of the lower prices. Turn to page A-24 of this issue of The Journal for information regarding prices. *Order now.*

Nebraska Dental Health Models

The accompanying photographs illustrate two sets of dental health models that were displayed at the Nebraska State Dental Association convention and at the Annual Session of the American Dental Association in San Francisco.

The models are about 18 inches in length and substantially made of light material; which facilitates handling. The photographs give a general idea of the display, but the color of the actual models adds considerably to their effectiveness.

The original models or duplicate sets may be secured by writing Mrs. Norma Edger, 939 Medical Arts Bldg., Omaha, Nebr.

Utah Establishes State Dental Program

The state of Utah has recently made provision for a dental health program. R. C. Dalgleish, the new dental director, is preparing a comprehensive dental health educational plan.

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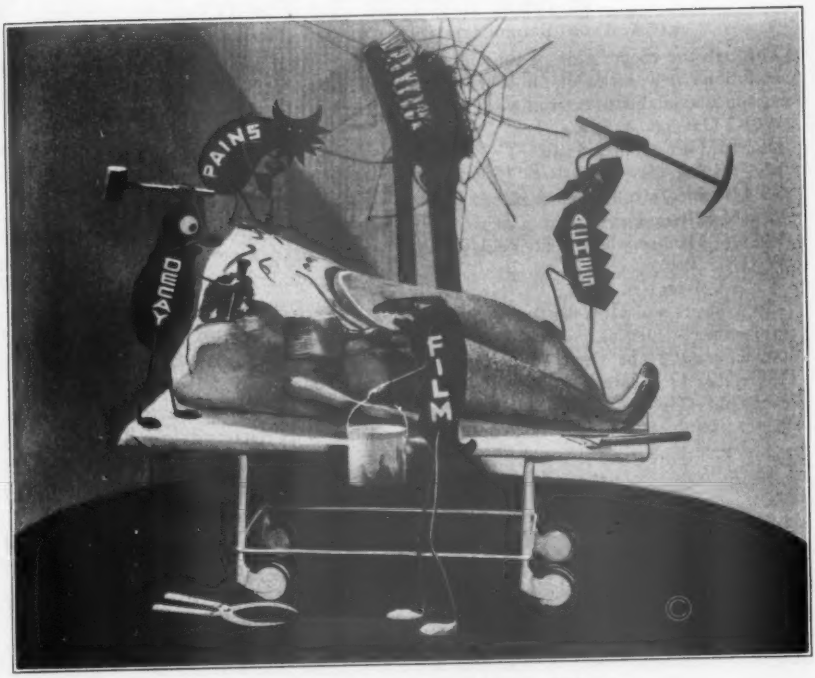
1. The material for this article was largely from "Natives of Sarawak and British North Borneo," by H. L. Roth, published in London by Truslove and Hanson, and from "Influence of the Sun on the Teeth," by Lilian Lindsay, J.A.D.A., 21:616 (April) 1934.



Nebraska State Dental Association exhibit.

Nebraska State Dental Association exhibit.

A.D.A. Radio Broadcasts Over Columbia Northwest Chain

Through the cooperation of the Columbia Broadcasting System, the American Dental Association's new series of radio programs, "Dental Customs of Primitive People," are being made available to the following stations:

WOC Davenport, Iowa
KRMT Des Moines, Iowa
KSCJ Sioux City, Iowa
KFAB Lincoln and Omaha, Nebr.
WISN Milwaukee, Wis.
WCCO Minneapolis and St. Paul, Minn.
WMBD Peoria, Ill.
WNAX Yankton, S. D.

The subjects and dates for the coming month are as follows:

November 3: Dental Decorations of the Bisayan Islanders
November 10: The Teeth of the Eskimo
November 17: Eskimo Dental Conditions
November 24: Tooth Mutilating Customs of African Natives

Hope for Lepers

Everything imaginable is done at Carville to make the lot of the lepers easier. Specialists of all sorts come weekly for consultation. I particularly admired the resident dentist. Leprosy affects the jaw bones frequently, and artificial reproductions have to be made. When leprosy gets into the respiratory passages the breath becomes unbearably foul. A special machine has been devised to pump gas into the affected areas to make them less offensive. But what makes the work heroic is that this dentist is constantly running the danger of breaking the skin of his hands and allowing the infection to enter. Not long ago a surgeon in Paris cut himself while operating upon a patient and lated developed leprosy....

For thousands of years any man, woman, or child on whom the blight of leprosy had fallen, knew himself condemned to a living death. Even thirty years ago no hope could be held out to these unfortunates, who were not even permitted by an unkind Providence to die of their disease, but must linger on for years of untold suffering and degradation. Wherever I have gone over the face of the earth I have visited colonies of lepers, and the change that has taken place is no less than miraculous. Nothing in my life has given me so much joy as to see the light of hope slowly kindled in faces once set in lines of despair. The lepers now feel themselves on the threshold of deliverance. They are patient because of the chance, however slight, that they may be once again restored to the world of men and life.—Victor Heiser in "An American Doctor's Odyssey."

DENTAL ECONOMICS

MICHIGAN FILTER SYSTEM

THE Michigan State Medical Society has undertaken to integrate all its activities in order to assure cooperation and prevent overlapping. One phase of the society's work has come to be of special importance in relation to the operation of two state laws, providing for free medical care for "afflicted children" and for "crippled children." The first is an exclusively state affair; the second is conducted in cooperation with the Federal Social Security Act, which provides about $100,000 annually as a subsidy from the federal government.

If financial and medical resources are to be used effectively and economically, two preliminary examinations are necessary before any assistance is given. The Michigan State Medical Society has assisted in the organization of two "filters" to be used in the selection of those who are to receive medical care. This system has been organized by the Public Relations Committee of the Michigan State Medical Society and seventeen district counselors.

L. Fernald Foster, of Bay City, chairman of the Public Relations Committee, explains the operation of this system as follows:

A. The county medical society appoints in each county of the state:

1. A medical filter: a board of physicians who shall decide on each applicant as to (*a*) medical need, (*b*) medical necessity and urgency, (*c*) necessary period of hospitalization and treatment.

B. The judge of probate appoints, with advice and counsel of the county medical society's representatives:

1. An economic filter: a social servicing agency, which shall determine (*a*) whether the patient can pay the existing fee of the private physician; (*b*) whether the parent is temporarily unemployed or a worker in the low-wage bracket who can pay the fee of the private physician on a "deferred payment plan"; (*c*) whether the parent is one who cannot now or apparently at any future time pay anything to his private physician.

An applicant under the Afflicted and Crippled Child Act should be referred first to the economic filter. If he is judged to fall in the economic group, he is worthy of consideration by the medical filter, to which he should next be referred. If his condition is medically needy or urgent, his commitment by the judge of probate should follow. All other cases rejected by either filter should return as private cases to the physicians of the patient's choice for disposition.

The economic filter is appointed by the probate judge of each county and is composed of laymen. Most of the counties of Michigan have a three-man board composed of the county poor commissioner, the superintendent of the poor and perhaps a state welfare agent or the probate judge. In certain of the larger counties, the regular social service investigation bureau is used. The medical filter is composed of physicians appointed by the county medical society.

After one county medical society in the state had operated this form of filter on "afflicted adults" (the responsibility of the counties, not the state) sufficiently long for its value to be shown, a joint committee of representatives of the Michigan State Medical Society, Michigan

Hospital Association, Michigan Association of Probate Judges, State Administrative Board, Crippled Children Commission and auditor general's office met, Oct. 30, 1935, in the office of the auditor general and adopted a resolution endorsing the "filter" system for crippled and afflicted children, and providing for the two committees described. June 4, 1936, Gov. Frank D. Fitzgerald issued an executive order providing:

"It is ordered that no state money shall be paid for the care and treatment of afflicted children until there has been filed with the Judge of Probate a statement by a parent or legal guardian, under oath and approved by the Economic Committee, giving fully the economic condition of the parents or guardians of said children, including the details of property owned and income received by all members of the family, and such other information as such Economic Committee requires—and until there shall have been a physical examination by said Medical Committee of said Filter Board, with a report thereof, in plain terms, filed with the Judge of Probate. If the Judge of Probate makes an order for the medical and/or surgical treatment, bills rendered to the state therefor shall be accompanied by certified copies, from the Judge of Probate of the county of both the Economic Committee report and the Medical Committee report."

This plan is now in operation in eighty-two counties in the state of Michigan. Michigan would appear to have worked out outlines of an experiment that may prove of great value in the organization of medical service. It is the first state to establish a state-wide method of selection on both economic and medical groups and to separate these so as to give both the lay and professional representatives as complete autonomy as is possible with close cooperation. It is an experiment which may well be studied with interest and profit by medical associations throughout the country.—*J.A.M.A.*, Sept. 26, 1936.

Thomas Parran: Surgeon General of the U. S. Public Health Service

Thomas Parran, Surgeon General of the U. S. P. H. S., was born at St. Leonard, Md., in 1892. In 1911, he graduated from St. John's College, Annapolis, Md., with the degree of bachelor of arts. In 1915, he received the degree of doctor of medicine from Georgetown University, and in the same year also the degree of master of arts from St. John's College.

In 1916, Dr. Parran entered the Public Health Service and for ten years was engaged in public health studies, administration and research in many states. From 1926 to 1930, he was in charge of the division of Venereal Diseases of the Public Health Service. In 1930, Governor Roosevelt appointed the then Assistant Surgeon General to the position of health commissioner for the State of New York, and when Hugh S. Cumming recently retired as Surgeon General, President Roosevelt appointed Dr. Parran to the position.

The Surgeon General supervises the distribution of about $20,000,000 in the interest of public health in the United States.

Dr. Parran is president of the American Public Health Association, trustee of the Phipps Institute of the University of Pennsylvania, a scientific director of the Rockefeller Foundation and a member of the technical board of the Milbank Memorial Fund.

His medical hobby is to remove the taboo from public discussion of venereal diseases in the United States, and to make syphilis as rare in this country as it is in the Scandinavian countries, to which he has made several trips.

Vermont Inaugurates Dental Division

The Vermont State Department of Public Health has recently established a bureau of dental hygiene. The new bureau functions in the Maternal and Child

Health Division. At the present time, the personnel of the bureau is limited to the director, C. J. Speas. The program is to be entirely educational. The cooperation of the members of the state dental society is sought to examine the mouths of the children and chart the cavities. Children will be sent to the offices of private dentists for all corrective work. Efforts will be made to concentrate all corrective work on first grade pupils.

Shorewood (Wisc.) Dental Hygiene Program 1935-1936*

The dental program conducted for the school children in Shorewood, Wis., is strictly educational. The dental hygienist, under the direction of the dental director, examines the teeth of all children and re-examines as many as is necessary. She gives toothbrushing instructions and dental health lessons, including health stories and talks to science classes, P.T.A. groups and parents' conferences; prepares and displays exhibits, movies, etc., and conducts dental inspections at the Summer Roundups.

In 1929-1930, when this program was started, 22 per cent of the children had good teeth. During the past seven years, this percentage has arisen until, at the end of the 1935-1936 school year, 86 per cent of the children had good teeth.

The Summer Roundup dental program is equally effective. Each fall examination shows that from 97 to 100 per cent of the children first entering school have good teeth.

*Dental director, Ewald C. Wetzel, D.D.S.; dental hygienist, Louise Munger.

Florida's Dental Health Department

The Florida State Board of Health has recently created a department of dental health. At present, the personnel of the new department consists of a consulting director of dental health, who serves without remuneration on the Florida State Board of Health, one full time director and one secretary. The director is required to take the course in public health dentistry given by the University of North Carolina.

The program, which is being developed with the cooperation of the Florida State Dental Society, is purely educational.

Bryant S. Carroll is consulting director of the Department of Dental Health on the Florida State Board of Health. E. C. Geiger is the director of the Department of Dental Health.

North Carolina's Public Health Dentistry Course

Are you interested in public health dentistry? The Committee on Dental Economics calls your attention to an article on page 1801 of the September, 1936, issue of The Journal, describing the course in public health dentistry given by the University of North Carolina at Chapel Hall. This is the first course of its kind ever presented in this country and one which every dentist in public health work should attend.

Dentists taking the course will be required to pass examinations in nutrition; child psychology; methods of teaching; visual education; public speaking, and communicable diseases.

Dentists will be required to attend lectures on, but will not be required to take examinations in public health administration; epidemiology; child hygiene; the principles and practice of sanitation; vital statistics; public health laboratory methods, and preventive medicine and hygiene.

In addition, the dentists will be required to make school inspections and teach mouth health in the schools under proper supervision and direction. Preventive dentistry is rapidly taking its logical position in public health work. Dentists who are in or who plan to enter this field are urged to avail themselves of this special training. Public Health dentistry can no longer be administered in the hit or miss fashion of the past. Its future depends on trained men and the University of North Carolina offers that training.

For further information, write to Charles S. Mangum, dean, School of Medicine, University of North Carolina, Chapel Hill, N. C.

ARE YOU INFORMED ON OFFICE MANAGEMENT, DENTAL ECONOMICS AND SOCIAL INSURANCE?*

Books on these subjects may be borrowed† from the

LIBRARY BUREAU
AMERICAN DENTAL ASSOCIATION
212 E. Superior St., Chicago, Ill.

Aly, Bower	Socialized medicine: 9th annual debate handbook. 2 vols. Columbia, Missouri, Lucas Bros., 1935. 75c each.
American Med. Assn., Bureau Med. Economics	Handbook of sickness insurance, state medicine and the cost of medical care. Chicago, Amer. Med. Assn., 1934. 35c
Asgis, A. J.	Outline of dental socio-economics. New York, Allied Dental Council, 1934. $1.00.
Bartlett, L. W., & Neel, Mildred B.	Compensations in the professions. New York, Association Press, 1933. $2.00.
Beck, Dorothy F.	Cost of equipping a dental office. Chicago, University of Chicago Press, 1932. $1.00.
Bosworth, H. J.	Dental economics. Chicago, Bosworth Economic Institute, 1932. $3.00.
Bregstein, S. J.	Business conduct of an ethical practice. Brooklyn, Dental Items of Interest Pub. Co., 1932. $4.00.
Bruce, Isabel C., & Eickhoff, Edith	Michigan poor law. Chicago, University of Chicago Press, 1936. $2.50.
Cabot, Hugh	Doctor's bill. New York, Columbia University Press, 1935. $3.00.
Chase, Stuart, Fairchild, H. P., & Overstreet, A. C.	Rich man, poor man. New York, Harper, 1935. $1.00.
Christie, A. C.	Economic problems of medicine. New York, Macmillan, 1935. $2.00.
Commission on Medical Education	Medical education and related problems in Europe. New Haven, Conn., Dr. W. C. Rappleye, 1930.
Committee on Costs of Medical Care	Medical care for the American people. Chicago, University of Chicago Press, 1932. $1.50.
Creech, Margaret	Three centuries of poor law administration. A study of legislation in Rhode Island. Chicago, University of Chicago Press, 1936. $3.00.
Davis, M. M.	Paying your sickness bills. Chicago, University of Chicago Press, 1931. $2.50.
Epstein, Abraham	Insecurity: A Challenge to America. New York, Random House, 1936. $4.00.
Falk, I. S.	Security against sickness. New York, Doubleday, Doran, 1936. $4.00.
Johnsen, Julia E.	Socialization of medicine. Vol. 10. (Reference Shelf) New York, Wilson, 1935. 90c.
Kells, C. E.	Dentists' own book, including a complete bookkeeping and recording system. St. Louis, Mosby, 1925. $7.50.

*Most of the recent books in this list are the gift of the Committee on Economics of the American Dental Association.

†Books may be *borrowed* by members of the Association for a period of one week after date of receipt; and if not reserved for some one else, the period will be extended on request. A deposit of $2.00 for each volume to be sent at one time should accompany all requests for books. This will be refunded on return of books.

Kent, E. N.	Business side of dentistry. St. Louis, Mosby, 1929. $5.00.
Lee, R. I., & Jones, L. W.	Fundamentals of good medical care. Chicago, University of Chicago Press, 1933. $2.50.
Leuck, Miriam S.	Study of dental clinics in the United States: 1930. Chicago, University of Chicago Press, 1932. $1.00.
Leuck, Miriam S.	Further study of dental clinics in the United States. Chicago, University of Chicago Press, 1932. $1.50.
Leven, Maurice, & Beck, Dorothy F.	Practice of dentistry and incomes of dentists in twenty states: 1929. Chicago, University of Chicago Press, 1932. $2.00.
Milbank Memorial Fund	Next steps in public health. New York, Milbank Memorial Fund, 1936.
New York Tuberculosis & Health Assn., Committee on Community Dental Service	Health dentistry for the community. Chicago, University of Chicago Press, 1935. $1.00.
Ochsner, E. H.	Social insurance and economic security. Boston, Bruce Humphries, 1934. $2.50.
Phelps, Edith M.	Socialization of medicine. New York, Wilson, 1930. 90c.
Rosenwald (Julius) Fund	New plans of medical service. Chicago, Julius Rosenwald Fund, 1936.
Rubinow, I. M.	Quest for security. New York, Holt, 1934. $3.50.
Rukeyser, M. S.	Doctor and his investments. Philadelphia, Blakiston, 1931. $2.50.
Shaffer, Alice, Keefer, Mary W., & Breckenridge, Sophonisba P.	Indiana poor law. Chicago, University of Chicago Press, 1936. $3.00.
Simons, A. M., & Sinai, Nathan	Way of health insurance. Chicago, University of Chicago Press, 1932. $2.00.
Suter, A. B. W.	Dentistry—a profession and a business. Rochester, N. Y., Ritter Dental Mfg. Co., 1930. $7.50.
United States Public Health Service	Dental survey of school children, ages 6-14 years etc. Public Health Bull. No. 226. Washington, D. C., Government Printing Office, 1936. 20c.
United States Public Health Service	Survey of dental activities of state departments and institutions of the United States. Public Health Bull. No. 227. Washington, D. C., Government Printing Office, 1936. 20c.
Walch, J. W.	Complete handbook on state medicine. Portland, Maine, Debaters Information Bureau, 1935. $2.50.
Walch, J. W.	Monthly supplementary rebuttal notes on state medicine. Portland, Maine, Debaters Information Bureau, 1936.
Walch, J. W.	Sample speeches on state medicine. Portland, Maine, Debaters Information Bureau, 1935.
Williams, Pierce, & Chamberlain, Isabel	Purchase of medical care through fixed periodic payment. New York, National Bureau Economic Research, 1932. $3.00.
Wolfenden, H. H.	Real meaning of social insurance. Toronto, Canada, Macmillan, 1932. $2.00.
Woodhouse, C. G., & Schiffman, Ruth Y.	Dentistry: its professional opportunities. Greensboro, N. C., Woman's College of University of North Carolina, 1934. $1.25.

Dentistry as a Career

A fine presentation of this subject is now available in reprint form. The author is L. E. Blauch, Ph.D., executive secretary, Survey Committee of the American Association of Dental Schools. The reprint includes information on the number of dentists, ratio to population, earnings, time spent at work, cost of education, list of dental schools, etc. Price 10c. Address Library Bureau.

CURRENT LITERATURE

Metastatic Gingival Adenocarcinoma from Primary Lesion of Colon (A. A. Humphrey and N. H. Amos, Am. J. Cancer, 28:128 [Sept.] 1936): In a case of primary adenocarcinoma of the colon with metastasis to the gingival tissue in a man, aged 33, the oral lesion was a pedunculated, soft reddish ulcerated mass about 18 mm. by 1 cm. near the maxillary first molar. The microscopic picture resembled that of the primary growth. Oral metastasis was first noted about six months after colostomy. At death, metastatic growths were found in the lung and liver. This case emphasizes the importance of histologic study of oral lesions with possible primary diagnosis of extra-oral neoplasms.

HAMILTON ROBINSON.

Course of Proprioceptor Fibers from Tongue (Donald H. Barron, Anat. Rec., 66:11, 1936): The peripheral parts of the following nerves of cats, rabbits and rats were prepared and attached to electrodes: the hypoglossal, lingual, chorda tympani and the nerve of Wrisberg. Action potential was recorded by use of an amplifier and loud speaker. It was impossible to set up impulses along the hypoglossal nerve by stretching, deforming or burning of, or application of acids, alkalis or salts to, the tongue. In all cases, it was possible to cause contraction of the tongue by faradization of the nerve. When the tongue was pulled, burned or touched, the lingual nerve recorded impulse discharges. No effect was produced with chemicals unless tongue tissue was destroyed. The chorda tympani produced impulse discharges under chemical stimulation of the tongue only. According to the author, the work suggests that the lingual not the hypoglossal nerve conducts proprioceptive sensation to the brain stem from the tongue, and that sensory fibers to the tongue musculature do not exist in the hypoglossal. The work, the author also believes, shows that a part if not all of the fibers conveying the sensation of taste from the anterior two-thirds of the tongue enter the brain via the nerve of Wrisberg.

GRANT VAN HUYSEN.

Focal Infection in Dermatology (S. Ayers, Jr. and N. P. Anderson, Arch. Derm. & Syph., 34:421 [Sept.] 1936): Focal infection is discussed in relation to skin disease. Teeth, tonsils, sinuses, middle ear, gallbladder, appendix, intestinal canal, genito-urinary tract, lower respiratory tract, bones, heart and skin are listed as possible foci. Both abscessed and pulpless teeth, even when roentgenograms do not reveal infection, should be considered. The assistance of specialists in making diagnoses is recommended. The need for transillumination and electrical conductivity tests, as well as roentgenograms, in oral examination is emphasized, as all pulpless teeth have been considered as probable foci of infection by the authorities cited. There are a large number of skin ailments which may have focal infection as the sole or a contributing cause. Treatment includes, primarily, removal or treatment of the infectious focus.

HAMILTON ROBINSON.

Red Blood Cell Sedimentation Rate in Chronic Sinusitis, Chronic Tonsillitis and Dental Periapical Infection (R. M. Lintz, J. Clin. & Lab. Med., 21:1259 [Sept.] 1936): The erythrocytic sedimentation rate is used as an index of the course of infectious arthritis. The author attempted to ascertain whether the observed decrease of rate accompanying clinical improvement might not be due to removal of foci. The sedimentation rate was determined on thirty persons with chronic sinusitis, thirteen with chronic tonsillitis, five with both chronic tonsillitis and sinusitis and twenty-seven with periapical infection. Of the seventy-five cases, sixty-nine (92 per cent) were within normal limits and the six pa-

tients with abnormal rates did not show very marked increase. The author concludes that chronic tonsillitis, chronic sinusitis and chronic periapical infection do not cause an increase above normal in the erythrocytic sedimentation rate.

HAMILTON ROBINSON.

FOREIGN LITERATURE

Scope of Teaching and Research in Anatomy (W. E. LeGros Clark, Brit. M. J., 2:413 [Aug. 29] 1936): The author confines his remarks to those aspects of the teaching of anatomy and anatomic research that call for special consideration because they are expressions of a new outlook in what is one of the most venerable of all sciences. One of the main duties of the teacher of human anatomy, is the provision of facilities for the study of the topographic anatomy of the human body by the students. The student should make a careful dissection of the whole body, and not be required to learn and commit to memory for examination purposes a vast amount of topographic details from a standard anatomic textbook. The author believes that the student should be tested for a knowledge of the details as he goes through his course of dissection. It is very important that the routine teaching of topographic anatomy form and structure always be correlated with function. The author states that omission has been made in this paper of such subjects as neurologic anatomy, radiologic anatomy, physical anthropology and the comparative anatomy of the primates only because the place of these in anatomic teaching and research is already fully recognized.

J. FRANK HALL.

Mixed Salivary Gland Tumors Situated in Hard Palate (J. Stewart Gourlay, Brit. M. J., 2:391 [Aug. 22] 1936): Mixed salivary gland tumors have been found in various situations in man, but it is somewhat uncommon to find them in the hard palate. The author describes a case wherein the hard palate of a man, aged 39, an oval tumor, measuring 1¾ by 1½ by 1 inch, enclosed in a fibrous capsul and covered on one aspect by mucous membrane was easily enucleated through an elliptical incision. On section, the tumor appeared firm, yellow, translucent and faintly lobulated. In some areas, the epithelial cells formed masses and strands; in some, the cells were attenuated and had a myomatous appearance, and in others, there was evidence of acini formation. There were several areas of pseudocartilage. R. Sonnenschein reviewed the previous literature on this subject in 1929 and noted less than fifty reported cases of palatal parotid tumors, and the general aspect of these neoplasms has been fully dealt with in recent years by D. H. Patey and J. McFarland. Patey mentions five examples of this condition in a review of fifty-five cases and, in the past few years, D'Aunoy, Beck, Heitz and Carruthers have also contributed to the literature on the subject. In the majority of the reported cases, the tumor has been located in the soft palate. In 1935, Jarman, and also Stobie, noted instances in which the hard palate was the site of election.

J. FRANK HALL.

Diet and Dental Conditions of English and Dutch, with Special Reference to Pathogenesis of Carcinoma of Stomach (W. E. Herbert and J. S. Bruske, Brit. D. J., 61:153 [Aug. 1] 1936; Guys Hosp. Rep., 86:301 [July] 1936): This survey was undertaken to determine whether differences of diet and oral health in the English and Dutch would account for the greater incidence (300 per cent) of gastric carcinoma in the latter. Five hundred patients were studied in each group. It was found that only 11 per cent of the English were fast eaters, whereas 58 per cent of the Dutch could be classed as such. Smaller percentages of the English (respectively 19, 22, 13 and 0 per cent) indulged in spiced foods, hot food, excessive smoking and tobacco chewing than did the Dutch (48, 43, 62 and 18 per cent). Gross oral sepsis was present in 28 per cent of the English as compared with 44 per cent of the Dutch, but 47 per cent of the former had less than half of the possible masticatory contacts, as compared with 39 per cent of the latter.

The efficiency of mastication, measured by the degree of comminution of carrot chewed for a fixed period of time, was not directly related to the numbers of points of contact of the teeth. The Dutch had only three meals a day, instead of four, and ate less meat and more bread (partly rye), cheese and vegetables.

B. G. Bibby.

Respiratory Disease in Preschool Child (A. Doyne Bell, Brit. M. J., 2:420 [Aug. 29] 1936): The respiratory mechanism differs from other systems of human organism in that it is put to strenuous work within a few minutes of the moment of birth. The circulation and digestive system are started very early, but the change is more gradual. There may be many congenital defects which predispose to respiratory disease. Among the most common are (1) prematurity with a debilitated condition of the young patient in which the respiratory apparatus especially suffers; (2) cleft palate and harelip, in which it is difficult to avoid infections of the nose and nasopharynx, which, if not controlled, will spread through the short, wide eustachian tubes of the infant to the middle ear and gives rise to a chronic otorrhea; (3) congenital laryngeal stridor, due to an exaggeration of the ordinary flexibility of the infantile larynx, which will disappear, although secondary respiratory infection is frequent; (4) atelectasis, a failure of a lung, or part of a lung, to expand, which is quite common in the new-born owing to obstruction of a bronchus by fluid inhaled in the child's first efforts to breathe. Certain conditions other than congenital defects causing respiratory infection are: chronic nasopharyngeal infections, dental caries, poor diet, improper clothing, overcrowding and many childhood diseases such as measles and whoopingcough.

J. Frank Hall.

Distribution of Oral Streptococci in Tissues (E. W. Fish and I. Maclean, Brit. D. J., 61:336 [Sept. 15] 1936): Although the authors were able, by histologic methods, to demonstrate streptococci in chronic abscesses and granulomas on the roots of the teeth, they conclude that these organisms do not normally invade the tissue and are satisfactorily withheld by the granulation tissue in pyorrhea pockets or on the apices of the roots. This conclusion they base on the absence of cellular reactions about the streptococci found in the tissues and the fact that they were unable to cultivate streptococci from roots when the gingival margins or pockets had been previously cauterized. It is their belief that streptococci cultivated from the roots of extracted teeth were forced into the tissues during the tooth extraction.

B. G. Bibby.

Compensatory Hypertrophy of Salivary Glands (Sull' ipertrofia compensatore delle ghiandole savilvari) (A. Pozzen, Arch. Ital d. mal. dell 'app. dig., 5:64, 1936; abstr. Surg. Gynec. & Obst., 63:104, 1936 (international abstract section by R. S. Somma): The author studied size and weight changes of residual salivary glands in dogs following partial sialectomy. He found that removal of one parotid or one submaxillary gland is not followed by any appreciable constant change in weight or size of the remaining gland. If both parotid and submaxillary glands be removed on one side, the remaining glands of the opposite side will be definitely increased in size and weight. Simultaneous removal of the parotid, submaxillary, sublingual and orbital glands on one side leads to a considerable increase in the weight and size of the corresponding remaining glands. The increase is most marked in the parotid gland. The process of hypertrophy progresses uniformly with the exception of the orbital gland, which, because of its peculiar anatomic relations, expands most downward and becomes most markedly hypertrophied in its lower third. Following partial sialectomy, the histologic picture of the remaining glands from seven to twenty-five days after operation presents characteristic changes indicating proliferative activity of the parenchyme. This is expressed by typical nuclear and protoplasmatic changes and the appearance of small aggregations of serous and mucous cells, tubules and

newly formed acini within the interacinous stroma. A few months later when hypertrophy is complete, the gland microscopically is found to be practically normal. Histologic examination of the oral mucosa and pharynx (vestibule, soft palate and pillars) reveals only slight hypertrophy of the regional mucous glands.

J. FRANK HALL.

Toothbrush (Lancet, 2:231 [Aug. 22] 1936): Dentists with hospital experience frequently see mouths with perfect teeth which are not clean by any social standards. Nine times out of ten, such teeth are never cleaned, and, consequently, with decreasing assurance, dentists advise their patients to clean their teeth. If an individual believes that the regular habit of cleaning the teeth with this or that antiseptic will provide immunity, he is the victim of a fallacy. Given a dietetic environment which favors immunity, teeth will remain healthy whether brushed or not, and in conditions favoring caries, it is doubtful whether toothbrush or drug will stave it off.

MISCELLANY

BOOK REVIEWS

X-Ray Technic and Interpretation of Dental Roentgenograms. By A. L. Greenfield, D.D.S., New York City. Associate Professor of Roentgenology at the New York University College of Dentistry, Lecturer on Dental Radiology at the New York University College of Medicine, Dental Radiographer at the Montefiore Hospital, Author of "Interpretation of Dental Radiographs" and "Das Lesen Dentaler Röntgenbilder," Lieutenant United States Naval Reserve (Special Service). 254 pages, with 466 illustrations. Price, $6. Published by Dental Items of Interest Publishing Co., Inc., Brooklyn, N. Y. Great Britain: Henry Kimpton's Medical Publishing House. 1936.

One of the most impressive things connected with the general make-up of this book is the unusually satisfactory character of the illustrations. This may be said to be typical of the material turned out by the present publishers. It is a pleasure to pick up a volume with the typography and cuts produced by this firm. Of course, this is largely due to the grade of paper used, and it would be well if other publishers of dental volumes would emulate their example.

Dr. Greenfield has illustrated so perfectly every item of technical procedure that it should be easy for the average operator to make satisfactory pictures. One of the most striking chapters relates to the subject of odontomas and adamantinomas with special reference to their association with impacted teeth. This book is a real education on this subject.

The volume as a whole must receive the fullest commendation.

Oral Diagnosis and Treatment Planning. A text for the dental student, a reference book for the practitioner and medical student. By Kurt H. Thoma, D.M.D., Charles A. Brackett Professor of Oral Pathology in Harvard University; Oral Surgeon to the Brooks Hospital; Consulting Oral Surgeon to the New England Baptist Hospital; Consulting Oral Surgeon to the Tumor Clinic of Beth Israel Hospital. 379 pages with 533 illustrations, 71 of them in colors. Philadelphia and London; W. B. Saunders Company, 1936. Cloth, $6 net.

It is really refreshing to be furnished a book by a dentist on a subject so far reaching and fundamental, and at the same time having such a practical application. Dr. Thoma has reached out into the basic consideration of the medical sciences, but has not lost touch with the every-day practical problems of the hour. The book is therefore not only sound scientifically, but

is also readable and most interesting. Its scope is very wide, but does not encroach on the domain of topics outside of its purview.

The illustrations may be termed "practical," and it is therefore never irksome to examine and study them. If some of the engravings, for example, Figure 286, seem too diagrammatic, it must be acknowledged that they illustrate a sound concept in pathology, and that they could not well be presented in any other way. The color plates are most impressive and rivet the attention of the reader as no other kind of illustrative matter can ever hope to do.

The publisher and author are to be highly congratulated on the excellence of this work.

The Science of Dental Materials. By Eugene W. Skinner, Ph.D., Associate Professor of Physics, Northwestern University, Dental School, Chicago, Ill. 411 pages, with 131 illustrations. Philadelphia and London: W. B. Saunders Company, 1936. Cloth, $4.50 net.

There can be no possible question of the great need for a knowledge of dental materials on the part of the dentist. The necessity for this is so patent and so fundamental that "he who runs may read," and this fact has finally impressed itself so firmly on the minds of the profession that more and more scientific men are studying this subject with ever increasing interest.

The present volume is a concrete contribution to the knowledge of the subject. It presents in readable form the essentials for a study of dental materials, and any practitioner's time is well spent who devotes it to a study of this volume. It deals not only with the fundamentals of the subject, but also with the technical aspects of its more practical application.

It has the unique virtue of being scientifically sound and at the same time intensely interesting.

Dental Surgery and Pathology. Third edition. By T. W. Widdowson, L.D.S., R.C.S., Eng., Dental Surgeon to King's College Hospital; Lecturer in Dental Anatomy, Dental Physiology, and Dental Histology to King's College, University of London; Member of the Board of Examiners in Dental Surgery to the Royal College of Surgeons, England; Examiner in Special Anatomy and Physiology to the University of London; External Examiner in Dental Surgery, Dental Pathology and Bacteriology, Dental Anatomy and Physiology, and Dental Materia Medica to the University of Liverpool; Member of the Board of Studies in Dentistry, University of London; Late Contributing Editor to *Oral Health* and *Dental Practice,* Toronto, Canada; Author of "Dental Anatomy and Physiology and Dental Histology," "The Care and Regulation of Children's Teeth," etc., etc., and E. V. B. Widdowson, L.D.S. R.C.S. Eng. With special chapters on "Treatment of Irregularities in Position of the Teeth." By L. Russell Marsh, L.D.S. R.C.S. Eng., Lecturer in Orthodontics, King's College Hospital; "Inflammation and Bacteriology." By Dr. H. A. Lucas, B.A., M.R.C.S., L.R.C.P., Assistant Pathologist and Lecturer in Dental Pathology, King's College Hospital; and "Dental Sepsis in Relation to the General Health, and Diseases Arising from Reflex Irritation." By John James, L.D.S. R.C.S. Eng., Dental Surgeon and Lecturer in Dental Surgery, King's College Hospital. 10 plates and 370 illustrations; 724 pages; price, 35 shillings net. Published by John Bale, Sons & Danielsson, Ltd., 83-91, Great Titchfield Street, London W. 1, England. 1937.

This is a book that must appeal with peculiar force to every student who has had the benefit of practical experience. A chapter on the deciduous teeth will be found very significant and of great value. Naturally, the subject of irregularities comes in for considerable discussion and, in the section on treatment, the usual diversity of opinion becomes apparent. All of this will be found suggestive and useful.

Dental caries has been studied with the theories in mind of its baffling manifestations and its inconclusive results. Verily the subject of dental caries is one of the perennials of the profession, and the clamor for its solution grows louder and ever louder. The colored plate of a carious

central incisor is particularly attractive.

In perusing those sections of the book that deal particularly with such diseases as caries, erosion and abrasion, the reader is struck with the inconclusive nature of many of the findings and this is only the logical conclusion of many of the foremost thinkers of the day. Manifestly, there is much yet to learn of this subject, and the present volume is an honest effort to remedy the difficulty.

The publishers have done their work most commendably.

PROCEEDINGS OF HULLIHEN DAY*

The meeting held on Hullihen Day, was called to order by Frank N. Carroll, who, after the invocation by the Rev. James M. Potter, announced that the meeting was to have a twofold purpose: (1) to offer scientific instruction and (2) to honor a fellow citizen and colleague of 100 years ago, Dr. S. P. Hullihen, who died at Wheeling in March, 1857, by making a pilgrimage to his tomb, he having recently been accorded the distinction of being the Father of Oral Surgery.

Mayor Schultze presented the key to the city to the visiting members of the profession. He stated that the work of such men as Dr. Hullihen had made possible the standing of the dental profession; that the profession in the United States were recognized as the dental leaders of the world, and, furthermore, that the American Dental Association, represented by its immediate Past President, Dr Winter, was to be congratulated for maintaining this standing.

Dr. Winter replied briefly, with a few appropriate remarks.

The sound film on "Exodontia," produced by Dr. Winter, was then shown, being received with a great deal of interest.

The pilgrimage to Mt. Wood Cemetery was made in motor cars with a police escort. This old cemetery lies on one of the highest hills in the vicinity, overlooking the beautiful Ohio River, and offers an exceptional panorama of the surrounding territory. C. Baxter Morris, president of the West Virginia Dental Society, opened the exercises. He spoke of the many obstacles and difficulties encountered in the days of Dr. Hullihen, many of which had now been removed and stated that we are today able to render a better service to our patients because of the work of pioneers such as Dr. Hullihen, who was a true scientist. Dr. Morris called attention to the inscriptions on the monument erected to Dr. Hullihen's memory by the citizens of Wheeling in 1858. He then directed Dr. Carroll and Dr. Armbrecht to lay a wreath on the grave, after which Rev. James M. Potter offered a prayer.

At the conclusion of the formal service, a general inspection was made of the monument inscriptions, which had been recut at the expense of the Wheeling District Dental Society. The luncheon at the Windsor Hotel was well attended. Oscar W. Burdats acted as toastmaster, introducing songsters Drs. Dorer, Jefferson, Schofield, Myers and Edwards, who rendered several selections and then led the assemblage in a few songs. A telegram was received stating that because of illness, Dr. Walter Hullihen could not attend as he had planned. The governor of the state was called on and made a few remarks designating his especial interest in the man whom we had gathered to honor and stating that the state was justly proud of his work. Edward C. Mills, secretary of the Ohio State Dental Association, speaking on the achievements of Dr. Hullihen, quoted from Thorpe's Dental History as follows:

"His passing closed the career of one of the really unique and original characters of our profession. A resolution by the medical faculty read, 'The eminent position which he had attained by his own extraordinary operations furnishes a striking illustration of how little genius is to be controlled by adverse circumstances.' ... Alexander Campbell wrote in the *Millen-*

*Reported by Edward C. Armbrecht, D.D.S., Wheeling, W. Va.

*Held during the Wheeling (W. Va.) Centennial Celebration, and sponsored by the Wheeling District Dental Society, Aug. 18, 1936.

nial (Bethany, Va.) Harbinger, May, 1857: 'His genius, science and art developed in the unprecedented and extraordinary operations performed by him in his profession have attracted the attention and constrained the admiration of the whole profession wherever he was known, from the banks of the Ohio to those of the Thames, from Boston to New Orleans. Among American surgeons he had no superior, probably no equal. In dentistry he was not equaled in America. He performed operations which, when exhibited in Great Britain, constrained certain journalists to announce that such like had never been performed in Great Britain.' "

The toastmaster then announced that the program would conclude by standing for one minute in silent tribute, facing the Hullihen oil portrait which had been hung high, illuminated and draped with the American flag. A short intermission followed and then the final scientific lecture was given by George B. Winter on "Routine Exodontia of Interest to the General Practitioner of Dentistry." At 4 o'clock, the meeting was adjourned so that the many interesting exhibits of the Wheeling Centennial Celebration might be seen. The committee was composed of the following members of the dental society: Drs. Broverman (chairman), Crowl, Hennen, Armbrecht and McConnell.

The list of honored guests were as follows:

H. G. Kump, governor of West Virginia.

Walter Hullihen, president of Delaware University (absent because of illness).

George B. Winter, past president of the American Dental Association.

C. Baxter Morris, president of the West Virginia Dental Association.

W. S. Fulton, president of the West Virginia State Medical Association.

Robert Armbrecht, president of the Ohio County Medical Society.

Jacob Schwinn, surgeon.

George Vieweg, president of the Jacob Schwinn Study Club.

Robert Reed, Sr., surgeon.

C. A. Wingerter, physician.

E. C. Mills, secretary of the Ohio State Dental Society.

Charles Schultze, mayor of Wheeling.

H. J. Humphrey, city manager of Wheeling.

Tom Bloch, chairman of the Centennial Committee.

R. Mason Hite, immediate past president of the West Virginia Dental Association.

E. R. Douglass, president elect of the West Virginia Dental Association.

A. J. Bush, professor in the crown and bridge department, Ohio State University.

THE WILLIAM J. GIES ENDOWMENT COMMITTEE FOR THE JOURNAL OF DENTAL RESEARCH

An organized effort is being made at this time to raise an endowment fund of not less than $50,000 for the *Journal of Dental Research.* Throughout the seventeen years of its existence, it has served the dental profession with distinction. It was influential above any other agency in obtaining recognition for dentistry as a scientific body by the American Association for the Advancement of Science. More than a thousand research articles have found publication in its pages. Its cumulative value to dentistry is beyond computation.

And yet, like most research journals, it has never been self-supporting. There has not been a single year since it began publication in 1919 in which there has not been an average deficit of not less than $2,000. The amount necessary to meet this recurring debt has been raised each year by its founder, no small part of which has been contributed by him out of the meager salary of a college professor.

There are those in the profession who feel that a situation such as this should not be allowed to continue; that if the profession of dentistry is worthy of the faith which Dr. Gies has shown in it by devoting more than twenty-five years of his life to its scientific advancement, it will not longer permit him to carry this financial burden. It is also believed that all that is needed to place the *Journal of Dental Research* on a firm financial foundation is to bring the

matter squarely before the profession, in order to obtain its wholehearted support.

It was with this in mind that the William J. Gies Endowment Committee for the *Journal of Dental Research* was recently formed. Its purpose is to raise a fund of not less than $50,000, by which it is hoped to place the *Journal of Dental Research* on a permanent financial basis and, at the same time, make the fund a memorial to Dr. Gies as an expression of appreciation of the service which he has rendered dentistry.

THE PROPOSED PLAN

In the effort to achieve its purpose, the committee has in mind three objectives:

1. An increase in the circulation of the *Journal of Dental Research* for the purpose of making it as far as possible self-supporting.

2. Support from advertising.

3. The creation of an endowment fund by which recurring deficits can be met and the usefulness of the *Journal of Dental Research* increased. It proposes to accomplish this (*a*) by establishing different classes of subscribers for the two-fold purpose of increasing circulation and adding to the endowment fund; (*b*) by the solicitation of legitimate advertising, and (*c*) by encouraging direct contributions to the fund.

The plan as at present outlined is as follows:

(*a*) Classes of subscribers:

1. Organization subscribers: Those who receive the *Journal of Dental Research* through some organization which subscribes for its entire membership; the cost to be $4 a year for each member.

2. Annual subscribers: Those who agree to subscribe to the *Journal of Dental Research* annually, paying for it the full subscription price of $5 a year.

3. Sustaining subscribers: Those agreeing to subscribe and pay $10 annually.

4. Endowment subscribers: Those paying $25 annually, $20 of which shall go to the endowment fund.

5. Life subscribers: Those making a payment at one time of $100, the entire amount to go to the endowment fund. Endowment subscribers may, on request, be transferred to this class at the expiration of four years as endowment subscribers; sustaining subscribers at the expiration of ten years.

(*b*) Support from advertising:

Having obtained a worthwhile subscription list, an effort will be made to increase income through the solicitation of legitimate advertising.

(*c*) Contributors to endowment fund:

In a further effort to increase the endowment fund, the committee proposes, in addition to individual donations, to invite the different dental organizations of the country to become contributors to the fund.

Contributors shall be of four classes:

1. Goodwill contributors, individuals and organizations who contribute any amount up to $250.

2. Donors, those making a payment of $250.

3. Patrons, those making a payment of $500.

4. Benefactors, those making a payment of $1,000 (payments to be made in installments when desired).

Contributors of $100 or more, may, on request, be given a life subscription to the *Journal of Dental Research*. In putting this plan into effect, an effort will be made to get in touch with every member of the dental profession through his local or state society in the belief that he will welcome an opportunity to have a part in preserving for dentistry one of its most valuable assets.

When a substantial amount of the fund has been subscribed by the dental profession, it is proposed to approach philanthropic organizations for their support, which it is believed will be forthcoming when it can be shown that the project has the active support of the profession. If, at any time the *Journal of Dental Research* should become self-supporting through increase in the number of subscribers or from advertising, the income from the fund may be used for research or any other worthy object in dentistry.

This, briefly, is a plan by which it is hoped, and believed, that the goal of not less than $50,000 can be reached. It is a plan in which every member of the dental profession can have a part by the payment of no more than $4. It offers an opportunity for every dentist to prove his idealism. For the *Journal of Dental Research,* it should be remembered, is the symbol of a great ideal. As such, it should have the active support of every member of the dental profession irrespective of whether he finds in its pages a solution to the practical problems of daily practice. Dental research must be encouraged if dentistry is to go forward. And who shall do this if not the dental profession?

ARTHUR H. MERRITT, D.D.S.,
Chairman of the Committee,
580 Fifth Ave.,
New York City.

NEWS

DEATHS

Fisher, W. S., La Porte, Ind; Chicago College of Dental Surgery; died August 13; aged 69.

Masters, Ernest E., Logansport, Ind.; University of Michigan, College of Dental Surgery, 1909; died August 31.

O'Neill, Arthur P., Philadelphia, Pa.; Temple University, School of Dentistry, 1906; died September 15.

Richmond, S. L., Lewisburg, W. Va.; University of Maryland, School of Dentistry, 1923; met death by accidental drowning while vacationing with his family; aged 34.

Roe, Joseph B., Lansing, Mich.; Northwestern University Dental School, 1910; died August 7; aged 53.

Seymour, Robert J., Philadelphia, Pa.; University of Pennsylvania, 1892; died July 29.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J.

Academy of Anesthesiology, New York City, November 18.

American Association of Dental Schools, Baltimore, Md., March 15-17.

American Dental Society of Europe, Paris, France, August 2-5.

American Society of Orthodontists, Chicago, April 19-22.

Chicago Dental Society, February 15-18.

Dental Protective Association, Chicago, December 21.

Greater New York Meeting, December 7-11.

International Association for Dental Research, Baltimore, Md., March 13-14.

National Board of Dental Examiners, December 4-5.

North Atlantic Orthodontic Society, New York City, December 16.

Society for the Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

Southern Society of Orthodontists, Atlanta, January 25-27.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

American Association for the Advancement of Science, Subsection on Dentistry, Atlantic City, N. J., December 28.

STATE SOCIETIES

November

Florida, at Orlando (5-7)
Ohio, at Cleveland (9-11)
Puerto Rico, at Mayaguez

February

Minnesota at Minneapolis (23-25)

April

Alabama, at Mobile (12-14)

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Wisconsin, at Milwaukee (19-22)

May

Illinois, at Springfield (11-13)
New York, at New York City (4-7)
North Carolina, at Pinehurst (3-5)
Pennsylvania, at Pittsburgh (4-6)
South Dakota, at Mitchell (10-11)
Tennessee, at Knoxville (10-13)
Virginia, at Virginia Beach (10-12)

June

Maine, at Rangeley (25-26)

STATE BOARDS OF DENTAL EXAMINERS

California, at San Francisco, December 7. Kenneth I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, November 17-21. Almond J. Cutting, Southington, Recorder.

Iowa, at Iowa City, December 14-18; May 31-June 4. Hardy F. Pool, Mason City, Secretary.

Minnesota, at Minneapolis, December 11-17. Paul Hagen, Crookston, Secretary.

New Hampshire, at Manchester, December 17-19. Otis M. Littlefield, Manchester, Secretary.

New Jersey, at Trenton, December 7-12. State Board of Registration and Examination in Dentistry, 148 W. State St., Trenton.

Wisconsin, at Milwaukee, December 14-18. S. F. Donovan, Tomah, Secretary.

Texas, at Dallas, December 7-10. R. T. Weber, Austin, Secretary.

MINNESOTA STATE DENTAL ASSOCIATION

The fifty-fourth annual meeting of the Minnesota State Dental Association will be held in the Municipal Auditorium, Minneapolis, February 23-25.

L. M. CRUTTENDEN, *Secretary,*
1353 Lowry Bldg.,
St. Paul.

GREATER NEW YORK DECEMBER MEETING

The twelfth Greater New York Meeting will be held December 7-11 at the Hotel Pennsylvania, New York City.

GEORGE C. DOUGLASS,
Press and Publication,
Room 106A,
Hotel Pennsylvania,
New York City.

DENTAL SOCIETY OF THE STATE OF NEW YORK
(Change of Date)

The date of the sixty-ninth annual meeting has been changed from May 11-14 to May 4-7.

CHARLES A. WILKIE, *Secretary,*
233 Bible House,
New York City.

PENNSYLVANIA STATE DENTAL SOCIETY

The sixty-ninth annual meeting of the Pennsylvania State Dental Society will be held at the William Penn Hotel, Pittsburgh, May 4-6.

C. J. HOLLISTER, *Business Manager,*
800 Capital St.,
Harrisburg.

SOUTH DAKOTA STATE DENTAL SOCIETY

The fifty-fifth annual session of the South Dakota State Dental Society will be held in the Corn Palace, Mitchell, May 10-11.

ERNEST W. ELMEN, *Secretary,*
Sioux Falls.

VIRGINIA STATE DENTAL ASSOCIATION

The next meeting of the Virginia State Dental Association will be held at Virginia Beach, May 10-12.

J. E. JOHN, *Secretary,*
Medical Arts Bldg.,
Roanoke.

CALIFORNIA STATE BOARD OF DENTAL EXAMINERS

The next examination to be conducted by the Board of Dental Examiners of California for license to practice dentistry and for license to practice dental hygiene will be held in San Francisco commencing December 7, at Physicians & Surgeons Col-

lege, 344 Fourteenth St., San Francisco. All credentials must be in the office of the secretary at least twenty days prior to the date of the examination. Address all communications to

KENNETH I. NESBITT, *Secretary,*
450 McAllister St.,
San Francisco.

NATIONAL BOARD OF DENTAL EXAMINERS

The National Board of Dental Examiners will hold examinations December 4-5 for candidates taking Part I and Part II. Sessions will be held in schools where there are five or more candidates. Circulars of information and application blanks may be obtained from

MORTON J. LOEB, *Secretary,*
66 Trumbull St.,
New Haven, Conn.

DENTAL PROTECTIVE ASSOCIATION OF THE UNITED STATES

The annual meeting of the Dental Protective Association of the United States will be held at the Chicago Athletic Association, 12 South Michigan Ave., Chicago, December 21 at 4 p. m. The report of the officers will be given; a board of directors will be elected, and such other business transacted as should come before the association. All members are urgently requested to be present.

By order of the Board of Directors
E. W. ELLIOT, *Secretary,*
55 E. Washington St.,
Chicago.

NORTH ATLANTIC ORTHODONTIC SOCIETY

The next meeting of the North Atlantic Orthodontic Society will be held in the Hotel Pennsylvania, New York City, December 16, with registration at 9:30 a.m.

EDWARD A. LUSTERMAN, *Secretary,*
185 West End Ave.,
Brooklyn, N. Y.

ACADEMY OF ANESTHESIOLOGY IN ORAL SURGERY

The Academy of Anesthesiology in Oral Surgery will meet November 18 at the George Washington Hotel, New York City. If interested in attending this meeting please communicate with

J. M. ESKOW, *Secretary,*
147 Market St.,
Perth Amboy, N. J.

AMERICAN ASSOCIATION OF DENTAL SCHOOLS

The American Association of Dental Schools will meet March 15-17 in Baltimore, Md.

W. J. GIES.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH

The International Association for Dental Research will meet March 13-14 in Baltimore, Md.

W. J. GIES, *Secretary,*
632 W. 168th St.,
New York City.

DENTAL INTERNSHIPS

A competitive examination will be held December 26 at 10:00 a. m. at the Queens General Hospital to fill two vacancies for dental internship. Candidates must show evidence of graduation from a dental school registered by the regents of the University of the State of New York. Service will begin on July 1, 1937 and will terminate on June 30, 1938. The Queens General Hospital is a new active general city hospital, a unit of the Department of Hospitals of the City of New York. The hospital has a capacity of 636 beds, which include fifty-four beds devoted to contagious diseases, and offers excellent opportunities in dental training. The work in the hospital consists mainly of exodontia and minor oral surgery. The salary is $15 a month, with maintenance. Write for application blanks to the medical superintendent of the Queens General Hospital, Jamaica, L. I. Applications will be received until Monday, December 21, at 5:00 p. m.

MARCUS D. KOGEL,
Medical Superintendent.

DENTAL INTERN APPOINTMENTS

Written examination for appointments as resident dental interns at Lincoln Hos-

pital, Department of Hospitals, New York City, will be held during Christmas week of this year, for appointments to be made for 1937-1938. Applications should be made at once to

M. HILLEL FELDMAN,
730 Fifth Ave.,
New York City.

MOUNT SINAI HOSPITAL LECTURE COURSE IN DENTAL MEDICINE

The lectures in the sixth lecture course in dental medicine, season of 1936-1937, Mount Sinai Hospital, New York City, will be held October 8, November 12, December 10, January 14, February 11, March 11 and April 8, in the Laboratory Annex Room. All lectures start promptly at 8:30 p. m. Dentists and physicians are invited.

HARRY A. GOLDBERG.

INAUGURATION OF DEPARTMENT OF DENTAL AND MAXILLARY DISEASES, VIENNA

Beginning early in October, a department of dental and maxillary diseases will be in operation in the General Policlinics in Vienna, under the direction of Prof. Otto Hofer. Besides the instruction offered previously to physicians practicing dentistry secondarily, permanent special and postgraduate courses will be given to which all Austrian and foreign physicians may be admitted after previous inscription. The address is Vienna IX, Mariannengasse 10.

PARIS DENTAL CONVENTION

The thirteenth Paris Dental Convention will be held November 26-29 at the School of Odontotechnic of Paris, 5 Rue Garanciére, Paris (VI).

RENE SUDAKA, *General Secretary,*
143 Avenue Emile-Zola,
Paris (XV), France.

BUREAU OF HUMAN HEREDITY

The object of the Bureau of Human Heredity is collection on as wide a scale as possible of material dealing with human genetics. Later, the tasks of analysis of material and distribution of the information available will be added. The bureau is directed by a council representing medical and scientific bodies in Great Britain. It is affiliated with the International Human Heredity Committee, which ensures cooperation in all areas where research is proceeding. The Council would be grateful to receive all available material from institutions and individuals, furnishing well-authenticated data on the transmission of human traits whatever these may be. Pedigrees are particularly desired; twin studies and statistical researches are also relevant. As research workers and others who send in material may in some cases wish to retain the sole right of publication (or copyright), those who so desire are asked to accompany their material with a statement to that effect. Material should be given with all available details in regard to source and diagnostic symptoms, and the name and address of the person or persons who vouch for their accuracy should be included. All such details will be regarded as strictly confidential. Reprints of published work would be most acceptable. Further, many authors when publishing material may also have collected a number of pedigrees which they have been unable to reproduce in detail. It is the object of the council that such records, by being included in the clearing house, should not be lost. Those wishing a copy of the Standard International Pedigree Symbols may obtain one from the office, 115 Gower St., London, W. C. I., England. Announcements in regard to the services undertaken by the bureau will be published from time to time.

R. RUGGLES GATES, *Chairman.*

CORRECTION

On page 2000 of the October issue, reference is made to attendance of four colored dentists at a course in public health dentistry given in Atlanta-Southern Dental College. This is an error, as only white students attend the college in question.

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1936-1937

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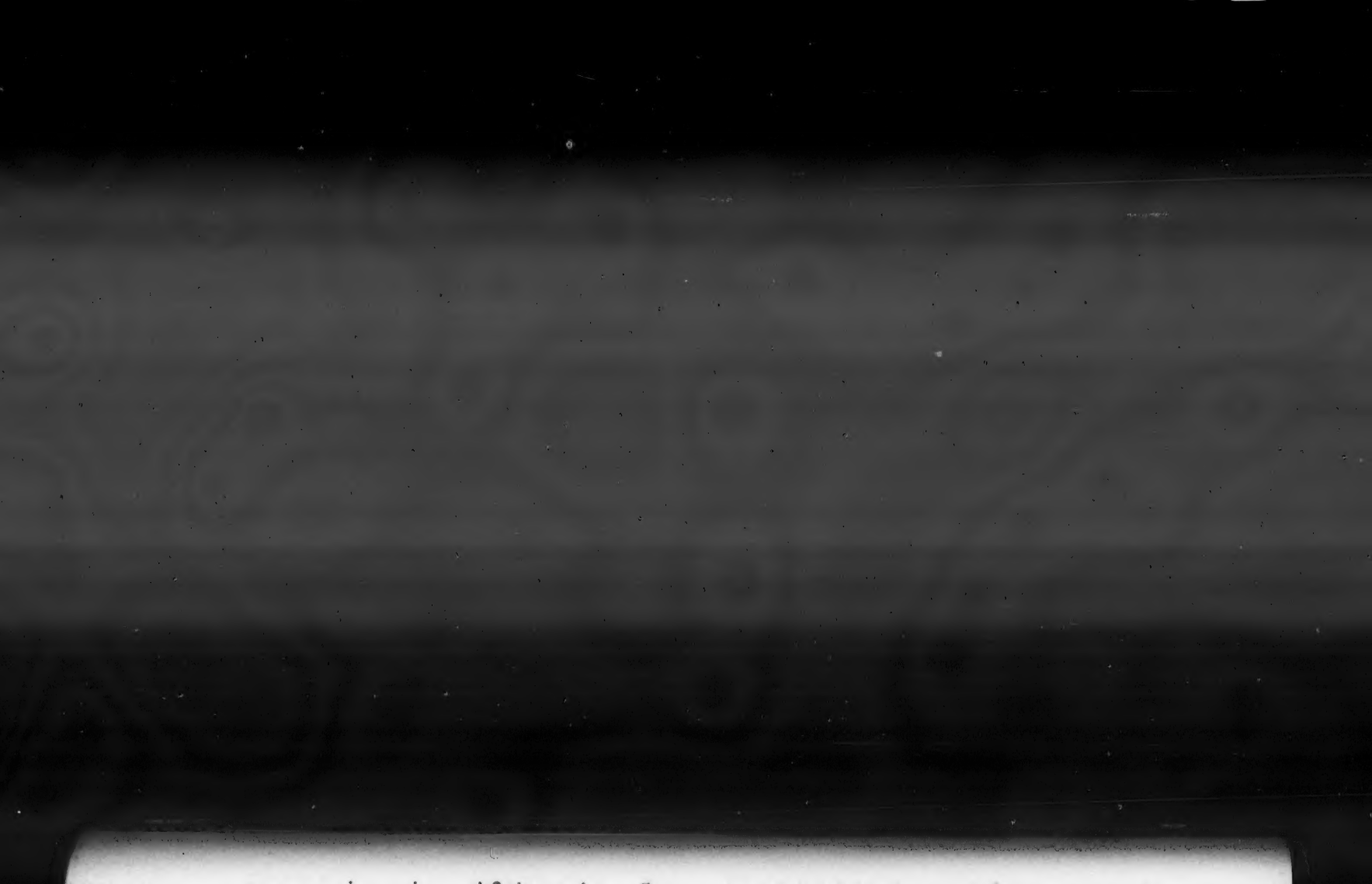
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